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SCIENTIFIC PUBLICATION IN INDIA

A BIBLIOGRAPHY of scientific journals recently issued by the UNESCO contains nearly 200 titles of publications from India. A perusal of the list will show that the journals are quite extensive in range and cover almost all the important branches of scientific research. On the face of it, therefore, the position regarding scientific publications in our country might appear to be satisfactory; but in fact the situation does not warrant any such complacency on our part, for the vast majority of the journals are rather seriously handicapped by lack of proper finances.

At present, it is rarely the case that a society sponsoring a scientific journal is also in a position to meet fully the cost of its publication. The subscription rate has necessarily to be kept low so as to have a reasonable circulation, and the deficit has to be made up partly from advertisements, but mainly by subsidies from the Government. Some journals also receive grants from universities and other philanthropic institutions. While it is laudable that such support is available, it restricts the activities of the journal in many ways. Firstly, the grants are mostly made on an yearly basis only. Also, the continuance of the grants is never definitely assured so that any long range planning becomes difficult. Naturally, the selection of subject-matter for publication has to be decided not only by its quality, but also by the availability of space, which is restricted by financial considerations. Thus, many articles which would otherwise be perfectly suitable for publication have to be returned because of this factor.

A similar situation existed also in the case of the journals of the U.S.A., particularly on account of the heavy pressure on space due to the widely expanded research programme during and after the war. The solution which has been devised by them seems to be perhaps the best under the circumstances. Finding that the volume of matter deserving publication far exceeded their resources, the American Journals are charging a good percentage of the cost of publication to the *institutions themselves* who forward these articles, reprints being supplied to them free of cost. This solution seems to be perfectly just and reasonable, for it will readily be admitted that publication is an integral part of every research programme and any finance set apart for the programme should also include the cost

of publication and reprints. In this connection, it is interesting to read the following statement by the American Physical Society: "It is gratifying that with few exceptions, the articles published in all American Physics Journals now receive this institutional support which makes possible publication of a considerable number of pages of scientific material which otherwise could not appear." It hardly needs to be emphasized that a similar procedure, if also adopted in our country, would greatly improve the financial position of the journals.

Apart from these considerations, the introduction of such a procedure would also lead to various other improvements. One obvious defect that is noticed in many of our journals is that the quality of the articles accepted for publication is not as high as would be desirable. This is mainly due to the fact that there is a great tendency on the part of research workers to rush into print every new result, without waiting to consolidate the position. Also, where a paper is particularly good, a report of it is sent abroad for publication in preference to journals in India. This arises mainly from two causes; firstly, since the circulation of many of our journals is not large enough, an important contribution published therein is quite likely to be overlooked; and secondly, the time of publication is also long, and often not definite.

Under these circumstances, the suggestion that the institutions should pay for the cost of publication would go a long way towards removing these difficulties. Clearly, when the financial position of the journal improves the time of publication can also be made quite short, and this should induce good papers being sent for publication to journals in India instead of abroad. Once the standard of our journals is raised, there is bound to be a larger demand for them abroad and in this way the circulation would automatically shoot up. Further, if it is necessary to pay for the publication, there would be a preliminary selection of material at the source itself, so that the quality of the articles received for publication would improve considerably.,

There is, however, a definite class of scientific journalism which is apparently unrepresented in India, *viz.*, semi-popular expositions of scientific results, as in the *Scientific American*, *Science et Vie* or *Discovery*. This class of journalism has a vital role to play in keeping the general public abreast of the latest developments in science and helping them to take an active interest in its progress, which obviously is the only way of obtaining adequate public support for scientific research.

NOBEL AWARDS FOR PHYSICS AND CHEMISTRY, 1951

THIS year's Nobel Prize for Physics has been awarded jointly to the British Physicists, Sir John Cockroft, Director of the Atomic Research Establishment at Harwell and Prof. E. T. S. Walton, of Dublin University, in acknowledgment of their fundamental work on the transmutation of elements. Working at the Cavendish Laboratory, Cambridge, under the direction of the late Lord Rutherford, Cockroft and Walton produced the first artificial transmutation of an element in 1932 by bombarding lithium by means of protons accelerated to a voltage of more than one million volts in a special cascade generator constructed by them. Lithium was thus converted into two α-particles. They also succeeded in transmuting a number of other elements, *e.g.*, boron to beryllium, fluorine to oxygen, sodium to neon, etc. This was the starting point of a new field of nuclear physics and was followed by the construction of larger and more powerful accelerators, such as the van der Graaf generator, the cyclotron and the synchrotron, and ultimately by the well-known developments leading to the release of atomic energy. While these atom smashing machines were used in the early days for the production of new isotopes of known elements, they have recently been able to produce new elements themselves.

Appropriately enough, the Nobel Prize for Chemistry has been awarded jointly to Profs. Seaborg and Macmillan of the California University who have played a notable part in the discovery and study of these new transuranic elements. They and their co-workers have definitely identified five such elements, Neptunium (93), Plutonium (94), Americum (95), Curium (96) and Berkelium (97) and also studied their chemical properties, isolating them in a pure state by ultramicrochemical techniques. None of these elements have been found to occur in nature, because all their isotopes have relatively short half-periods and they are therefore rightly termed "synthetic elements".

THE INDIAN SCIENCE CONGRESS, CALCUTTA, 1952

THE Thirty-ninth Annual Session of the Indian Science Congress is being held at Calcutta during the first week of January, 1952. Dr. J. N. Mukherjee, one of Professor Donnan's "three musketeers", distinguished for his pioneering work in the field of colloid chemistry, at present the Director of the National Building Research Institute at Roorkee, is the President-elect of the Session and will preside over the meetings. Prime Minister Jawaharlal Nehru is expected to address the delegates.

A distinguished delegation of visiting scientists will attend the Session and actively participate in the proceedings. So far as we know, the delegation includes Dr. William A. Sodeman, Professor of Clinical Tropical Medicine, Louisiana, Dr. Jasper H. Kane, the discoverer of Terramycin and Director of Biochemical Research and Production of Chas. Pfizer Co. Inc., New York, Dr. Charles A. Werner of Chas. Pfizer & Co., New York, Prof. J. C. Werner, President, Carnegie Institute of Technology, U.S.A., Dr. G. W. Rake, Director, Squibb Institute of Medical Research, U.S.A., Dr. P. Evans, Geologist of the Burmah Oil Co., London, Dr. E. C. Bullard of the National Physical Laboratory, Teddington, Dr. Dupouy, Director of National Centre of Scientific Research, Paris, Dr. Erwin Brand, Paris, Dr. J. M. Trepod, Chief of Pharmacological Laboratory, Ciba, Berne, Professor Arthur Stoll, President, Council de la Chimie, Basle, Switzerland, and Professor J. B. S. Haldane, England. The delegation consists mostly of biochemists, medical men and leaders of pharmaceutical industry.

During the Session, no less than forty symposia covering a large number of subjects, are scheduled to take place. Most of the subjects chosen are reminiscent of the titles of well-known treatises on the subject. It is doubtful if it would be possible to do justice to the formidable array of the topics chosen for discussion. It is generally feared that such ambitious programmes usually result in diffuse, amateurish and inconsequential discussions. It may, therefore, be advisable to arrange for a more modest programme comprising subjects of topical value and realistic significance. It would then be possible to bestow deeper thought on the subjects and thereby, enhance the prestige and scientific value of the proceedings.

It is generally felt that the time has arrived when the scope and functions of the Indian Science Congress should be thoughtfully reviewed. With the establishment and growth of the Academies and several specialist scientific societies representing different branches of science, it may perhaps be desirable that the Indian Science Congress should orient its activities in a manner which does not duplicate the efforts of the other organisations.

The Indian Science Congress Association, the oldest of our science organisations in the country, represents not only men of science but also those interested in the advancement of science. The Association with such a cosmopolitan and liberal outlook, is eminently fitted to carry the message and teachings of science to the people of our great subcontinent. We have no doubt that this question which has been engaging the attention of many of our leaders in science, will be discussed at the policy meeting of the Indian Science Congress Association.

INFLUENCE OF ANTIBIOTICS ON THE GROWTH OF SILKWORMS

IT has been found that antibiotics, particularly aureomycin and chloromycetin, enhance the rate of growth of silkworms. An increase in the larval weight amounting to 15 to 20 per cent. at maturity, has been obtained with worms dosed with antibiotics. The worms treated with antibiotics look healthier, moult easily and regularly, possess a keener appetite and exhibit greater activity. A more efficient utilisation of the feed is secured by means of these antibiotics and the retention of the leaf and supplemented nitrogens, is greater in the case of worms dosed with aureomycin and chloromycetin. There was also a 10-15 per cent. increase in the yield of silk. Terramycin which was also tried, was found to have relatively little effect on the growth of the worms.

Experiments both at the Indian Institute of Science and at the Govt. Experimental Sericultural Farm, Government of Mysore, with the foreign races of silkworms which are particularly susceptible to diseases—flacherie and grasserie—showed that when the Japanese multivoltine race (N-112) is dosed with chloromycetin, the worms do not suffer from any of the diseases while among the untreated batches, the disease incidence amounted to 20 per cent.

'X-RAY MICROSCOPE' EMPLOYING LAUE REFLECTIONS

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Principle of the Method

THE refractive index for X-rays is very nearly equal to unity, so that refractive focussing of X-rays by lenses, as for ordinary light, is practically impossible. However, total reflection of X-rays takes place at small glancing angles (of the order of a few minutes of arc for ordinary wavelengths)[1] and utilising this phenomenon, X-ray focussing devices have been constructed.[2,3] Since the image obtained from a single concave mirror is highly astigmatic, two mirrors with their planes of reflection at right angles are employed, and images, having a magnification of upto 30 with a field of view of about 0·5 mm. have been obtained. Kirkpatrick[4] has also suggested a possible method of refractive focussing, which has not been tried, but does not appear to be promising owing to the large absorption in most materials.

The present note deals with a new method of obtaining focussed images, utilising the Laue reflection from crystallographic planes. As its very name implies, the Laue reflection obeys the optical laws of reflection with respect to the plane concerned; but it differs from ordinary reflection in that for a particular angle of incidence θ only a small range of wavelengths near selected values, given by the well-known formula $n\lambda = 2d \sin \theta$ will be reflected. Thus, if white X-rays are incident on a thin cleavage flake, a portion of the rays would be reflected in the same direction as ordinary light would be, if incident on the same angle as the X-rays. Suppose now that the lattice planes in the crystal are bent into the form of a concave spherical surface, and that we have a point-source of X-rays along the axis of the "concave mirror". Then, a certain fraction of the incident X-rays would be reflected and *the whole of this* would converge again to a point. Thus, an enlarged or diminished image is formed by X-rays at exactly the same place as the optical image obtained by illuminating the object with ordinary light. Apart from the aberrations of the mirror, the only contributor to the "background illumination" of the image is the Compton scattering from the crystal flake, which is comparatively weak, being incoherent.

Experimental Arrangement

The above ideas were tested by means of a very simple experimental arrangement. The essential part is a crystal plate, whose lattice planes have been distorted to form the surface of a sphere. This is obtained as follows: A thin cleavage strip of mica M (0·04 mm. thick) is fixed by means of wax on the circular brass flange F of a tube of inner diameter 1 inch (Fig. 1). On evacuating the inside of the tube,

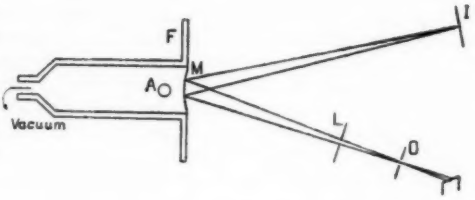

FIG. 1. Schematic Diagram of the Experimental arrangement.

the mica curves inwards, and if the central portion alone is utilised, then a fairly good optical image is obtained employing the mica as a mirror. In this way, a radius of curvature as small as 15 cm. (focal length 7·5 cm.) could be obtained. The difference of pressure on the two sides of the mica was of the order of 40 cm. Hg. The object O employed was a 100 mesh brass wire net, kept on an aperture in a lead screen. A lead aperture, L, was used to limit the beam diverging from O. The photographic film for recording the image I can be fixed on a stand sliding along an arm AI, which rotates about an axis A, which is also the axis of rotation for the tube bearing the mica mirror. Initially, the whole arrangement is removed from near the X-ray tube, the wire mesh is illuminated by ordinary light and the distances OM and MI suitably adjusted to get an image of the required magnification on a ground glass screen at I, to one side of the object. The arrangement is replaced near the X-ray tube and a photographic film is placed in the same position as the ground glass plate. With an ordinary demountable copper target X-ray tube working at 40 KV and 15 ma, exposures of the order of 30 min. are needed for a magnification of 4 and of the order of 6 hours for a magnification of 20.

Results

Three photographs obtained in this way are reproduced in Fig. 2 *a*, *b*, *c*. They are all contact

prints of the X-ray films and the magnifications are indicated in the caption to the figure. Fig. 2*a* shows that with a small field of view, the image is quite sharp and almost undistorted. The field of view in Fig. 2 *b* is fairly large of the order

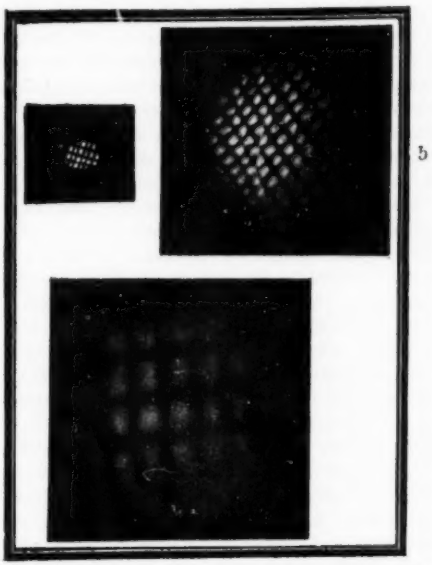

FIG. 2. Magnified images of a 100 mesh brass wire net, obtained by X-rays. The magnifications are for (*a*) ×3½, (*b*) × 6, (*c*) × 20.

of 2 mm. diameter; but there is a certain amount of distortion owing to the unevenness of the mica surface. Efforts are being made to modify the technique of bending the mica to get rid of this. It is to be noted that the image is sharp even at a magnification of 20 (Fig. 2 c). In all the figures, the magnifications in the vertical and horizontal directions are not equal because the image is to one side of the object.

Thus, it is clear that the new method of obtaining enlarged photographs with X-rays is workable and the exposures are not too large. The theoretical resolving power of this method is much larger than for the method employing total reflection. In the latter case, the limit of resolution is estimated to be about 3,000 Å for X-rays of wavelength about 1 Å.[5] Here, it should be very much smaller than this, if spherical aberration is made small, because diffraction alone would lead to a value of the order of the wavelength of X-rays. Therefore, it is necessary to devise suitable methods whereby the lattice planes could be curved to such a surface as to reduce spherical aberration. Two other possible methods of curving a crystal plate into a concave surface may be mentioned, though neither has yet been tried. One is to bend a circular plate pressed by means of two concentric rings from either side and the other is to deform it plastically to the required surface. The former is suitable for quartz and the latter for rock salt.

In any case, there seems to be little doubt that the design of the "X-ray microscope" considered here will have a resolving power better than that of the optical or ultra-violet microscope. Unfortunately, however, it does not appear to possess a large magnifying power. The focal length cannot be made less than about 5 cm., so that even a magnification of 50 in one stage would require a distance of 2·5 metres between the mirror and the photographic film. Higher magnifications in a single stage are thus ruled out. When we consider combinations of two mirrors as in a reflection microscope, a complication arises because in a Laue reflection, the wavelength of the ray reflected from the first mirror depends on the angle of reflection, and this has again to be incident at exactly the same angle on the second mirror. However, this strict condition can be satisfied by a combination of two annular mirrors with their axes coincident, but the theoretical study shows that the magnifications m_1, m_2 of the two mirrors are not independent. The total magnification $M = m_1 m_2 = m_1(2-1/m_1)$, so that $M \leqslant 2m_1$. Thus there is not much of an advantage in such a combination, in so far as magnification is concerned. However, it has the merit that the image is now along the axis and thus, there is no difference in the magnification in two perpendicular directions, as is the case with a single mirror.

Thus this instrument is not a suitable one for obtaining a very large magnification; however by using moderate magnification with X-rays and having further stages of enlargement optically, it is possible to obtain a resolving power better than the optical microscope. So also the greater penetration of X-rays would enable it to be used in circumstances where the electron microscope is inapplicable because of heavy absorption.

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THE ADSORPTION OF SYNTHESIS GAS AND ITS COMPONENTS ON FISCHER–TROPSCH CATALYSTS

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THE Fischer-Tropsch Process for the commercial synthesis of liquid hydrocarbons from modified water-gas is, perhaps, one instance of a technical chemical process in which interest in the reaction mechanism went almost *pari passu* with its industrial development. Ever since its discovery in 1926, the mechanism of the reaction, with special reference to the function of the catalyst, has been the subject of considerable controversy.

In the reaction mechanism originally proposed by Fischer and his co-workers[1] and later extended by Rideal[2] and Craxford,[3] it was postulated that metallic carbides were formed as intermediate products out of the chemisorbed carbon monoxide and that these were reduced by the gaseous hydrogen present to form methylene groups which in turn link up to form the paraffin chains. Matsumura[4] slightly modified this hypothesis by suggesting that chemisorbed hydrogen was required to reduce the carbide to methylene radicals.

On the other hand, Elvins and Nash[5] proposed that carbon-hydrogen-oxygen complexes were more probable than carbides as intermediates in the Fischer-Tropsch synthesis, since oxygenated compounds were always found in the final products along with the hydrocarbons. Hamai[6] suggested a similar mechanism according to which enolic complexes were formed on the surface by the interaction of adsorbed carbon monoxide with adsorbed hydrogen.

Investigations carried out during the past three years in the United States of America[7] have produced a considerable volume of evidence to disprove the carbide hypothesis and all its affiliations. Instead, the alternative proposal of an adsorbed reaction complex of carbon monoxide and hydrogen seems to be gaining support.

Both schools of thought, however, accept the importance of the adsorption, or rather the chemisorption, of the reactant gases as a vital step in the formation of the active substrate. The controversy arises mainly with regard to the subsequent transformation of this substrate under synthesis conditions: whether it enters into a reaction with the catalyst metal and thus gets fixed as carbide, or whether the adsorbed molecules interact with each other so as to form C-O-H complexes chemisorbed on the surface. It is evident that a considerable knowledge on this aspect of the controversy could be derived from a systematic study of the adsorption of the reactant gases, more especially from their mixtures, on the catalysts, at temperatures progressively approaching, without yet reaching, the minimum temperature of appreciable reaction.

Such studies were initiated in the General Chemistry Laboratories of the Indian Institute of Science, Bangalore, in 1945 and the results so far obtained with cobalt catalysts are indeed interesting and informative. The first two catalysts studied had the compositions: (A) Co 34%, Cu 4%, ThO_2 2·33%, Ce_2O_3 0·24% and the rest kieselguhr, and (B) Co, Cu, ThO_2 and Ce_2O_3 same as in (A) *plus* 4% Cr_2O_3 and the rest kieselguhr. Brief reports of these investigations have appeared in this journal and elsewhere[8] and a more detailed account was presented before the Division of Fuel, Gas and Petroleum, of the XIIth International Congress of Pure and Applied Chemistry held at New York in September last.

On these catalysts, the individual adsorptions of carbon monoxide and hydrogen were studied at a series of temperatures not only from the pure gases but also from $1\,CO : 1\,H_2$* and $1\,CO : 2\,H_2$* mixtures at temperatures ranging from 25 to 97° C. The adsorption studies from the mixtures were made with the aid of a thermal conductivity meter, specially designed for quick response and small dead space. The thermal conductivity measurements were also unaffected by pressure variations between 10 and 80 cm. At the maximum temperature at which measurements were made of mixed adsorption, namely, 97° C., it was verified by thermal conductivity reading as well as by independent chemical analysis, that the gas pumped out of the adsorption tube was free from traces of hydrocarbons, water and carbon dioxide. In general, the results appeared to be the net resultant of two opposing effects, namely, (1) a mutual suppression of the adsorption of each gas as would normally be expected from the Langmuir Theory[9] and (2) an enhancement of the adsorp-

* These denote the initial compositions of the gas admitted.

tion of either constituent due, in all probability, to interaction and complex formation in the substrate.

It is quite possible for the two effects to take place simultaneously on different parts of the surface. Since chemical complex formation would require an activation energy, there would be negligible complex formation at low temperatures and the net result would be a suppression of the adsorption of one gas in the presence of the other. As the temperature increases, however, substrate-interaction or surface complex formation takes place to an increasing extent with the result that at a certain temperature (still below the reaction temperature) the adsorption from mixtures surpasses that determined at the same temperature and at equivalent pressures from the pure gas. This has been found to be the case with the adsorption of carbon monoxide on catalyst A and of hydrogen on catalyst B. In either case, the adsorption from the mixtures up to 76° C. was lower than that from the respective pure gases, while at the higher temperature, 97° C., there was a pronounced increase in the adsorption of either gas, relative to the pure gas isotherms. The adsorption of hydrogen from mixtures on catalyst A was found to be markedly higher than the pure gas isotherms, even at the lowest temperature studied, namely, 25° C., indicating that at a still lower temperature the suppression effect would have become evident.

On both catalysts it has been observed that the adsorption of each constituent commenced to increase with temperature at much lower temperatures than in the absence of the latter. In other words, when compared with the adsorption isobars of the pure gases, the positions of minimum adsorption of the same gases from the mixtures were, as a rule, shifted substantially to lower temperatures. For instance, the isobars for the adsorption of pure carbon monoxide passed through a minimum at *ca* 90° C.; this minimum was shifted to *ca*. 50° C. when the adsorption of carbon monoxide took place from 1 : 1 mixture.

A further interesting observation was made with catalyst B. When the simultaneous adsorptions of the constituent gases were plotted against each other, the 'isotherms' so obtained tended to become linear especially at the higher temperatures. At 97° C., after an initial equimolecular adsorption of either gas, the respective adsorptions increased further in the proportion of 2 CO : 1 H_2, even from mixtures containing 3 to 10 times as much hydrogen as carbon monoxide at equilibrium.

These observations, taken together, point to the possibility of a progressive formation of CO-H complexes on the surface of the cobalt catalysts, under conditions approaching those required for the synthesis of hydrocarbons. Furthermore, observation of the kinetics of mixed adsorption, facilitated by the use of the thermal conductivity meter, indicated a progressive replacement of part of the initially adsorbed hydrogen by carbon monoxide in the course of the formation of these CO-H complexes.

Independent corroboration of the results of mixed adsorption on catalyst B was received from experiments[10] in which the effect of the prior-adsorption, or 'pre-sorption', of each gas on the adsorption isotherms of the other was determined at 52°, 76° and 97° C., employing the technique of Griffin.[11] While small amounts of hydrogen presorbed on the catalyst led to a marked enhancement of the adsorption of carbon monoxide at all the temperatures, the effect of a pre-sorption of carbon monoxide was to lower the hydrogen adsorption. As a rule, the adsorption of each gas on the catalyst, pre-treated with a given (small) dose of the other, increased with temperature, so that it could reasonably be expected that the adsorption of hydrogen on the "poisoned" surface would, at a few degrees above 97° C., exceed the value found on the clear surface.

Some interesting experiments have just been carried out[12] which indicate the absence of any extensive amounts of carbide on the surface of a cobalt catalyst under synthesis conditions. In these studies, synthesis and carburization runs alternated with measurements of the surface area and CO-chemisorption at low temperature. The latter is generally considered to represent a measure of the free, exposed, cobalt on the surface.[13] Synthesis gas was passed over an active cobalt catalyst, while the temperature was gradually raised from 150° C. to 190° C. As soon as the volumetric contraction reached 70%, the catalyst was flushed with nitrogen at 200° C. to remove physically sorbed vapours and further degassed by evacuation at the same temperature. The value of the CO-chemisorption obtained for the catalyst after this treatment was 75% of the value found for the fresh catalyst after reduction and prolonged evacuation at 300° C. This clearly demonstrates that at least 75% of the substrate in synthesis could be 'cleared' by evacuation at the reaction temperature. That this could not have happened had

there been any extensive carbiding of the catalyst, was shown by another experiment in which the catalyst was deliberately carburized by passing carbon monoxide for nearly 32 hours at 200° to 250° C. Evacuation at 300° C., after this treatment, did not restore more than 25% of the original value for the chemisorption of carbon monoxide. The carbided catalyst was also found to be almost inactive in hydrocarbon synthesis. Only a little methane, but no higher hydrocarbons, was produced, possibly by the slow reduction of the carbide by the hydrogen present.

These researches, concerning the nature of the active substrate in the Fischer-Tropsch reaction lead to the conclusion that a chemisorbed complex of the reactants, such as CO-H, rather than a metal carbide, is the intermediate precursor to $-CH_2-$ groups. This view places us in agreement with the results of two recent investigations reported from the U.S.A. Employing the 'tracer' technique, Kummer, *et. al.*,[14] have shown that "either ethyl alcohol or some surface complex formed by the adsorption of ethyl alcohol behaves as an intermediate in hydrocarbon synthesis over iron Fischer Tropsch catalysts and that at least the first of the added carbon atoms attaches itself principally to the α-carbon atom of the surface complex". Drawing a parallel between the formation of branched chain hydrocarbons and that of branched chain alcohols in an operating Fischer Tropsch unit, Weitkamp[15] concludes that the same mechanism operates in both cases.

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OIL REFINERY TO BE ESTABLISHED IN BOMBAY*

DURING his recent visit to the U.S.A. and U.K., Dr. Bhatnagar, who was entrusted with the task of exploring the oil refinery problem, held discussions with the Standard Vacuum Oil Company and Caltex in New York, and with the Burmah Shell and B.O.C. in London. These companies showed their willingness to start oil refineries in India and discussions were continued in India after his return. The proposal which has now been accepted by the Government of India is the result of this discussion. According to the agreement signed on November 30, the Standard Vacuum Oil Company of New York will instal a million ton oil refinery at Trombay, near Bombay.

To facilitate the project, the Government of India have given certain assurances to Standard Vacuum, including exemption from compulsory acquisition for a period of 25 years and exemption from certain provisions of the Industries (Development and Regulation) Act. Standard-Vacuum on their part have assured Government that the refinery would be completed as early as possible, that an adequate number of Indian personnel will be trained in refinery operations for employment in the refinery and that byproducts of the refinery will be made available for subsidiary Indian industries.

The Company has already brought out to India a group of marine engineers and refinery experts who will collaborate with the Government of Bombay and the Bombay Port Trust officials for the necessary improvements in the dock and harbour facilities near the site where the refinery would be set up, and for the solution of other preliminary technical problems. The company hopes to bring the refinery into actual production within four years.

This is the first instance in which large-scale foreign investment is coming to India with a view to setting up a vital, new and complicated industry. Discussions are at the moment proceeding with other oil companies which may lead to additional refineries being established.

* By courtesy of Sri. B. N. Sastri, Chief Editor, Publications Division, C.S.I.R., Delhi.

METABOLIC INTER-RELATIONSHIPS BETWEEN FOLIC ACID AND VITAMIN B_{12}

A. SREENIVASAN

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SEVERAL recent reports indicate that folic acid and vitamin B_{12} have more or less defined biochemical functions other than their established involvement in hæmopoiesis. However, there has been no direct experimental proof hitherto of specific enzyme systems associated with either vitamin and regulating cellular metabolism. The fact that folic acid and vitamin B_{12}, despite their dissimilarity from a chemical standpoint, should function so interrelatedly in diverse processes would only make such studies more intriguing.

Among systems known to be influenced by the two hæmatinics may be mentioned those involved in (i) the oxidations of purines, choline, glycine and D-amino acids, (ii) the metabolism of tyrosine, serine and glycine, (iii) nucleic acid biogenesis, and (iv) transmethylations. Relevant literature has been cited in recent publications from this laboratory.[1-5] An explanation of the observed metabolic interrelationships between the two vitamins has been sought for on the basis of the following well-known synthetic step in nucleic acid metabolism:

$$\text{Precursors} \xrightarrow{(1)} \text{Thymine} \xrightarrow{(2)} \text{Thymidine}$$

in which steps (1) and (2) are catalysed respectively by folic acid and vitamin B_{12}. Indeed, clinically and biochemically, such a step could be taken as having been established unequivocally.[6] Nevertheless, this inter-relationship would seem obviously insufficient to account for the other apparently unrelated enzyme systems enumerated above.

Unpublished data (referred to in[1]) have indicated that plasma levels of folic acid as well as stored folic acid in livers of experimental chicks are influenced by dietary vitamin B_{12} fed as condensed fish solubles especially at low levels of folic acid ingestion. Typical results are summarised in Table I.

This potentiating effect of vitamin B_{12} on the mobilisation of folic acid has since been confirmed with crystalline vitamin B_{12}.[8]

It is pertinent to refer here to certain significant observations on the metabolic economy of folic acid. Micro-organisms which synthesize their own requirement of folic acid from precursors elaborate this vitamin largely as folinic acid or the *citrovorum factor*[4] which is undoubtedly the physiologically more active form of folic acid;[2] folinic acid is the form present both in the cells and in culture filtrate. On the other hand, organisms requiring exogenous folic acid for growth do not synthesize appreciable folinic acid activity in culture filtrates whereas the folic acid taken in the cells is present as folinic acid (unpublished data). Likewise, stored folic acid in rat liver which is nearly equally distributed between the particulate and supernatant fractions exists almost entirely as folinic acid.[9] A similar intracellular distribution pattern for vitamin B_{12} would show that it is concentrated in the mitochondria. These findings suggest that folinic acid is dynamic and functions in varied enzyme systems while the role of vitamin B_{12} may be more specific and confined only to certain enzymes of the mitochondria. It is tempting to speculate whether the effect of vitamin B_{12} on the mobilisation of folic acid is in part at least attributable to a function for it in the conversion of folic acid to folinic acid. A recent report observes increased urinary folinic acid excretion in immature rats following administration of vitamin B_{12} or whole liver powder.[10]

TABLE I

Influence of Vitamin B_{12} on the Utilization of Dietary Folic Acid

Dietary folic acid (*gamma* per cent.)	Without iodinated casein		With 0·03% iodinated casein	
	Basal diet	Basal diet +3·0% fish solubles	Basal diet	Basal diet +3·0% fish solubles
	Blood folic acid (*gamma* per 100 c.c.)			
0	0·30	0·38	0·30	0·45
10	0·36	0·46	0·35	0·49
50	0·46	0·55	0·36	0·49
200	0·84	1·10	0·60	0·95
	Liver folic acid (*gamma* per g.)			
0	1·31	1·77	1·34	2·15
10	1·70	1·93	1·48	1·96
50	1·93	2·23	1·75	1·83
200	3·42	3·63	2·80	2·78

Day-old chicks, ten to a group, were employed; the basal diet was a purified dextrin-casein ration as given in[7] with the substitution of pure corn dextrin for sucrose. Data above relate to samples at end of four weeks.

We may examine further the inter-relation between folic acid and vitamin B_{12} with special reference to transmethylations. Of all biochemical functions attributed to the two vitamins, that relating to choline and methionine metabolism has perhaps been the most significant. An inter-dependence between these two methylating compounds on the one hand and folic acid and vitamin B_{12} on the other has been observed in the nutrition of several species, mice, rats, dogs, chicks, etc.[11] also.[1,3,4] More specifically it has been demonstrated that methionine,[12] creatine[3] and nicotinamide (unpublished observations) metabolism are influenced by one or both of the vitamins. Choline oxidase activity is also related to vitamin B_{12}[13,14] and to folic acid.[15]

For a proper attempt at interpreting these observations, one should take into account established facts concerning the biosynthesis of methyl groups which could occur in the tissues of the rat[16] from the *alpha* carbon of glycine and the *beta* carbon of serine as well as from formate and methanol[17,18]; the ethanolamine moiety of choline could be derived from serine by decarboxylation.[19,20] The reverse step, namely, the degradation of labile methyl to formate could also take place.[16-20] There are indications that the neogenesis of methyl groups is mediated by folic acid and vitamin B_{12}[21-23] but their exact significance in methyl economy has as yet remained obscure.

Since folic acid is concerned directly with formate production from glycine[24] and with its utilization for serine synthesis[3,24] and possibly in other single carbon addition reactions such as nucleic acid formation,[5] its sparing action on labile methyl requirement would seem explicable on the basis that the latter functions in transmethylations[3] as well as in the transfer of glycine to serine and in other one carbon fragment fixation processes mediated by formate. In folic acid deficiency methyl drain to formate could occur excessively. Some proof of this possibility has been forthcoming from our observations on the impairment of normal creatine and nicotinamide metabolism in folic acid deficiency and on its partial restoration by administered methanol or formate (Table II).

The possibility is not excluded that folic acid in the above experiments might also act by accelerating methyl biogenesis from administered precursors. However, this latter argument is not in harmony with our later findings that in folic acid deficient mice there occurs no more synthesis of choline or methionine from exogenously administered precursors, methanol and serine, as a result of folic acid supplementation than from metabolically derived precursors (Table III).

TABLE II

Effect of Formate or Methanol on Creatine and Nicotinamide Metabolism in Folic Acid deficient and Replete Mice

Group	Urinary creatine[3]	Urinary N^1-methyl-nicotinamide *[25]
	(mg./100 g body wt./24 hrs.)	
Basal diet ..	1·57	71·0
Basal diet + formate ..	1·68	88·0
Basal diet + methanol ..	1·73	102·2
Basal diet + folic acid ..	1·80	119·0
Basal diet + folic acid + formate	1·86	117·6
Basal diet + folic acid + methanol	1·88	122·9

Adult mice, inbred Swiss strain, were used, not less than four to a group in each case. Basal diet was the folic acid-free purified ration[3] with 15 gamma per cent. of vitamin B_{12}. Folic acid was administered orally at 10 *gamma*/mouse/day while methanol or formate was given intraperitonially at 1 mg./mouse/day.

*In addition to that present in the basal diet, the animals here received 1 mg./day each nicotinamide during the urine collection period of 48 hours following an equilibration period of 2 days.

Urine samples were collected on the 8th and 9th days following the grouping after the onset of folic acid deficiency on the basal diet as shown by a hæmogram; this preparatory period was 5 weeks.

The fuller data and related observations will be published by P. Fatterpaker, U. Marfatia and A. Sreenivasan.

TABLE III

Probable non-involvement of Folic Acid in Methyl synthesis from Precursors

	Folic acid deficient		Folic acid replete	
	Choline	Methionine	Choline	Methionine
	(mg. per g. of liver)			
No precursors	5·08	5·44	6·05	5·77
Methanol + serine	5·40	5·60	6·42	6·00

Basal ration and administration of folic acid as in the previous series. Precursors (1 mg. methanol and 2 mg. of *dl*-serine) were given in solution intraperitonially on the 8th day after grouping following overnight fasting; animals were killed 6 hours later following access to

feed for the last 5 hours. Choline was determined with a *Neurospora* (cholineless) *crassa* mutant[26] and methionine colorimetrically.[27] Details will be published by P. Fatterpaker, U. Marfatia and A. Sreenivasan.

It would seem therefore that folic acid is not directly concerned in methyl synthesis but that it contributes to methyl conservation and hence to increased transmethylations through inhibition of degradation to formate. On the other hand, it may be that vitamin B_{12} promotes such synthesis from precursors[21-23] besides being implicated in choline to betaine[14] and to methionine[3,28] transformations, although methionine may be formed from precursors independently of choline.[29] The synergism between folic acid and vitamin B_{12} in transmethylations would thus arise from a check by the former and an acceleration by the latter on the catabolic and anabolic aspects respectively of methyl metabolism.

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PROFESSOR K. N. BAHL

PROFESSOR K. N. BAHL has retired from the Chair of Zoology at the Lucknow University which he served with great distinction for nearly 30 years. It is very well known that under his inspiring guidance, Lucknow became the leading centre of zoological research in the country.

Professor Bahl's contributions to zoology fall into two categories. First may be mentioned his researches, especially on the morphology and physiology of the earthworms and other invertebrates. The elucidation of the structure, development and physiological function of the excretory system of earthworms may be regarded as his most important contribution. His tastes are, however, catholic and he has elucidated with great skill the details of pairing and egg-laying in the snail *Pila*, and the structure of the skull of the reptile *Varanus*.

And secondly, Prof. Bahl was the founder and editor of the now famous series, *Indian Zoological Memoirs* on Indian animal types, of which 8 volumes have so far been published. The publication of these memoirs is a land-mark in the history of Indian zoology, as they provide the basis for graduate and post-graduate teaching of morphological zoology of the invertebrates in India.

Professor Bahl was President, Zoology Section of the Indian Science Congress (1924), Foundation Fellow and President, National Academy of Sciences, Allahabad (1933-35), and a Fellow of various other societies. He has also been closely associated with the Zoological Society of India since its inception in 1939, and is the Society's President, having been elected to that distinguished office in 1950. Since his retirement Professor Bahl has accepted the Vice-Chancellorship of the Patna University.

Our heartiest good wishes to him for a long and happy life dedicated to the advancement of science.

M. L. ROONWAL,

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FLUORESCENCE TEST FOR THE *O*-HYDROXY-CARBONYL GROUP IN AROMATIC COMPOUNDS

Neelakantam, *et. al.*,[1-4] in a series of papers reported on the effect of adding a small amount of boric acid on the fluorescence, under u.v. light, of solutions of a large number and a wide variety of aromatic compounds containing the *o*-hydroxy-carbonyl group, dissolved in concentrated sulphuric acid. Reactions of limited utility were suggested for the detection of this group in hydroxy-acids by Jean-Renaud,[5] Anschütz[6] and Nölting[7]; in hydroxy-ketones by Pfeiffer[8] and hydroxy-anthraquinones by Dimroth.[9] Pyman's[10] test with ferric chloride is most commonly employed for the detection of the above group in hydroxy-ketones.

It has now been found that the fluorescence test is also applicable to 1-acyl-2-naphthols, as verified with eight such compounds recently synthesised by Sen and Bhattacharji.[11] The acyl groups were propionyl, butyryl, isobutyryl, caproyl, lauryl, myristyl, octonoyl and decanoyl. The test was carried out by dissolving the compound in concentrated sulphuric acid and treating one half of the solution with boric acid. The two halves were placed in quartz test tubes and examined under an U.V. analytical lamp in a dark room. Without the boric acid, the compounds exhibited no fluorescence in day light and a pale yellow fluorescence under U.V. light. On the addition of boric acid, there was no fluorescence in day light but under the lamp an intense fluorescence was observed in all these cases. The effect was quite marked.

Grateful thanks are due to Drs. Sen and Bhattacharji for providing the samples.

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October 18, 1951.

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$^5\Pi$–$^5\Sigma$ ELECTRONIC TRANSITION IN COBALT CHLORIDE

THE band spectrum of the diatomic molecule CoCl has been obtained using a heavy current discharge from a 2 K.W. D.C. generator in a specially designed quartz tube with hollow cylindrical electrodes. The bands are red degraded and occur in six groups extending from λ 6000 to 5300 Å. One of the groups extending from λ 5770 to 5650 Å stands out prominently and is considered as $\Delta v = 0$ group. The bands are line-like and are similar to the band systems obtained in MnCl[1] and FeCl.[2] The bands are of complex structure and show an abnormal intensity distribution among the heads and are assigned to the transition $^5\Pi - {}^5\Sigma$, involving quintet electronic states.

The wave numbers corresponding to the Q_5, Q_4, Q_3, Q_2 and Q_1 heads obtained in the 0, 0 sequence are 17638·8, 17555·9, 17484·1, 17411·0 and 17328·0 cm.$^{-1}$ respectively. The vibrational constants obtained in the present investigation are $w'_e = 412{\cdot}3$ and $w'' = 416{\cdot}0$.

Full details of the analysis will be published elsewhere.

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PHYSICO-CHEMICAL INVESTIGATIONS OF SOME MYSORE CLAY SAMPLES

THE properties of clays depend to a large extent on their clay mineral composition. The base exchange capacity and the differential thermal analysis of representative samples of Mysore clays were investigated in this laboratory with a view to classify the samples according to their clay mineral composition. The Mysore clays were collected from (*i*) Gullahalli, (*ii*) Bageshpur, (*iii*) Tirthahalli, (*iv*) Gollahalli, and (*v*) Hebbur, and kindly supplied by Dr. N. V. Raghunath of Government Porcelain Factory, Bangalore. The clay samples were passed through a 100 mesh sieve and dried over phosphorous pentoxide at room temperature.

The base exchange capacity of the clays, determined by the ammonium acetate method described by Kelly, *et. al.*,[1] are given in Table I. The base exchange capacity is given as the number of milliequivalents of ammonia taken up by 100 g. of the clay sample. The base exchange capacity of standard clay minerals is also given in this Table.

TABLE I

Clay sample	Base Exchange capacity	Reported values for the base exchange capacity of standard minerals	
i) Gullahalli	3·0	Kaolinite	3–15
ii) Bageshpur	7·4	Halloysite	6–20
iii) Tirthahalli	4·3	Illite	20–40
iv) Czechoslovakia	7·8	Montmorillonite	60–100
v) Gollahalli	18·1		
vi) Hebbur	29·8		

The results indicate that samples (*i*) to (*iv*) belong to kaolinite group, while sample (*v*) may be halloysite whose base exchange capacity varies from 6 to 20. The base exchange capacity of samples (*vi*) on the other hand, indicates that this clay may be an illite.

The differential thermal analysis was carried out by the method of Norton[2] employing chromel-allumel thermocouples and the results are given in Fig. 1. The curves for samples (*i*) to (*iv*) indicate an endothermic peak at 625° C. corresponding to the temperature at which kaolinites lose the water. An exothermic peak at about 980° C. is also exhibited by each one of these curves which corresponds to the transformation of amorphous alumina to γ alumina. These characteristic peaks indicate that all these samples are kaolinites.[2] Gollahalli sample, on the other hand, has an additional characteristic endothermic peak at about 150° C., which is due to the adsorbed water of the halloysite.[2] Thus in the case of samples (*i*) to (*v*) the results obtained by the thermal analysis confirm those obtained by the base exchange capacity.

In the case of Hebbur clay, the thermal curve indicates two endothermic peaks at 250° C. and 700° C. respectively in addition to the usual peaks of kaolinites. The former two peaks are characteristic of montmorillonite.[2]

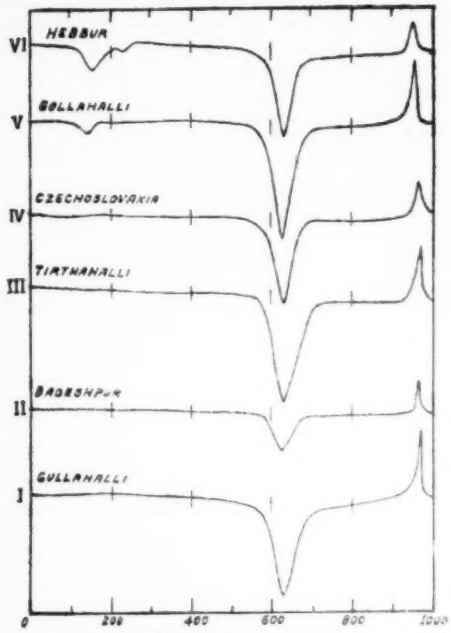

FIG. 1

It is thus clear that the Hebbur sample is not an illite as indicated by the base exchange capacity experiments. The high base exchange capacity of this sample must be due to the presence of small quantities of montmorillonite in the kaolinite sample.

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DEFLUORINATION OF PHOSPHATIC NODULES BY CHLORINE

THE removal of fluorine from rock-phosphate has attracted a good deal of attention during recent years, especially in the United States of America. Phosphorus in natural rock is only slightly available to growing plants. The availability of phosphorus in the sample is judged by its citrate solubility.[1] The presence of fluorapatite [$Ca_{10}F_2(PO_4)_6$] is assumed to be largely responsible for the low citrate solubility of the rock phosphate.[2] Most of the methods of defluorination of the rock phosphate involve the heating of the mineral at very high temperatures often ranging from 1,480 to 1,645° C.[3]

Investigations on the chlorination of phosphatic nodules (F = 3%; P_2O_5 = 25%) from Trichinopoly area indicated that considerable quantities of fluorine could be removed from the nodules at comparatively low temperatures. Chlorine was passed over briquettes of phosphatic nodules (10 g.) containing about 15% carbon at various temperatures. In presence of carbon, chlorine reacts with the nodules giving silicon tetrafluoride and phosphorus oxychloride as volatile products. The oxychloride was condensed by cooling the mixture to 0° C. and the uncondensed silicon tetrafluoride was hydrolysed by passing through water. The fluorine content of the aqueous suspension was estimated by the method of Willard and Winter.[4] After chlorination for 90 minutes, the residue was found to be practically free from fluorine. Representative results are given in Table I.

TABLE I

Defluorination of Phosphatic Nodules at Different Temperatures

Time in minutes	Percentage of flourine found in the aqueous suspension		
	400° C.	500° C.	600° C.
15	4·3	10·9	3·3
30	38·1	53·6	13·6
45	57·5	88·5	50·6
60	72·9	93·2	81·3
75	86·5	94·8	89·9
90	93·9	95·0	95·2

In order to study the nature of the chemical action during defluorination, chlorine was allowed to react with precipitated calcium fluoride at 500° C. employing the following mixtures:—

(1) Calcium fluoride only, (2) Calcium fluoride + 15% carbon, (3) Calcium fluoride + 40% silica, and (4) Calcium fluoride + 15% carbon + 40% silica. The results are given in Table II.

TABLE II

Time in minutes	Percentage of fluorine in the aqueous suspension			
	CaF_2 only	CaF_2 + C(15%)	CaF_2 + SiO_2(40%)	CaF_2 + C(15%) + SiO_2(40%)
30	..	..	..	50·1
90	1	8	1	58·4

When calcium fluoride was substituted by fluorapatite in the above chlorination experiments, the results given in Table III were obtained.

TABLE III

Time in mins.	Percentage of fluorine in the aqueous suspension		
	Fluoropatite only	Fluorapatite + C(15%)	Fluorapatite + C(15%) + SiO_2(3·5%)
15	..	15·5	22·1
30	..	27·6	40·4
50	..	34·9	62·7
90	19	38·8	96·1

Coronet Phosphate Co.,[5] has reported that a good percentage of fluorapatite can be converted into chlorapatite by chlorinating the fluorapatite between 1090° C. and 1315° C. But the results of the present investigation indicate definitely that in presence of carbon and silica, defluorination of fluorapatite can successfully be carried out at as low a temperature as 500° C.

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SYNTHESIS OF 4-METHYLSCOPOLETIN AND SCOPOLETIN

THE oxidation of 4-methyl-7-coumarinyl-*p*-toluenesulphonate by alkaline potassium persulphate gave 4-methyl-6-hydroxy-7-coumarinyl-*p*-toluenesulphonate which on methylation and subsequent removal of the *p*-toluenesulphonyl group gave 7-hydroxy-6-methoxy-4-methylcoumarin which was identical in respect of the m.p. and other chemical and physical properties with 4-methylscopoletin, synthesised by Baker and Evans[1] with the exception of the ferric chloride colour reaction. Whereas Baker and Evans' product gave a greenish colouration, our product gave the negative test. Our experience of this reaction with half-a-dozen coumarin derivatives containing the hydroxyl and methoxyl groups in the *ortho*-position supports this observation. Similarly, the oxidation with alkaline potassium persulphate of 7-coumarinyl-*p*-toluenesulphonate gave 6-hydroxy-7-coumarinyl-*p*-toluene-sulphonate which after methylation and subsequent removal of the *p*-toluenesulphonyl group gave 7-hydroxy-6-methoxy-coumarin or *scopoletin*, synthesised by Head and Robertson[2] by the application of the Perkin's Reaction to 2 : 4-dihydroxy-5-methoxy-benzaldehyde.

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1. Baker and Evans, *J. Chem. Soc.*, 1938, 374. 2. Head and Robertson, *Ibid.*, 1931, 1241.

PRODUCTION OF ITACONIC ACID BY *ASPERGILLUS TERREUS*

IT was discovered by Calam, Oxford and Raistrick[1] that certain strains of *Aspergillus terreus* can convert dextrose into itaconic acid. Later, Lockwood and Reeves,[2] Lockwood and Ward,[3] Moyer and Coghill,[4] and Lockwood and Nelson[5] described experiments in which dextrose in nutrient media containing corn steep liquor was converted into itaconic acid in about 30% yield in surface or agitated cultures.

Experiments were conducted by the authors using two strains of *Aspergillus terreus, viz.*, NRRL 255 and NRRL 1960, to study the optimum conditions for production of maximum yields of itaconic acid using dextrose (Dextrosol of Corn Products Company) and inorganic salts without the addition of any corn steep liquor. Preliminary experiments disclosed that only NRRL 1960 yielded appreciable quantities of itaconic acid and all further experiments were confined to this strain. Tables I, II, III and IV show the results obtained by varying the concentrations of one constituent at a time in a medium consisting of dextrose 15%, NH_4NO_3

0·2%, KH_2PO_4 0·1%, $MgSO_4 7H_2O$ 0·05%, KCl 0·05%, and HNO_3 20 mls. N/2 per litre. The mould was always grown in 250 mls. erlenmeyer flasks holding 66·7 mls. of the medium. Incubation was carried out at 34° C. and the itaconic acid was estimated by the method of Friedkin.[6] Yields were calculated on the dextrose consumed assuming that one mol. dextrose yields one mol. of itaconic acid. All values in the Tables are calculated for 100 mls. of original media.

TABLE I
(Concentration of NH_4NO_3 varied. Incubation Period 15 days)

	0·1% NH_4NO_3	0·2% NH_4NO_3	0·3% NH_4NO_3
Dextrose consumed (g.)	14·03	12·80	12·67
Itaconic acid (g.)	4·15	3·22	0·64
Yield (molar) %	40·9	34·8	7·0

TABLE II
(Concentration of KH_2PO_4 varied. Incubation Period 13 days)

	0·05% KH_2PO_4	0·1% KH_2PO_4	0·15% KH_2PO_4
Dextrose consumed (g.)	13·05	14·25	14·40
Itaconic acid (g.)	3·75	3·82	3·75
Yield (molar) %	40·0	37·1	36·1

TABLE III
(Concentration of $MgSO_4$ varied. Incubation Period 15 days)

	0·025% $MgSO_4$	0·05% $MgSO_4$	0·075% $MgSO_4$
Dextrose consumed (g.)	10·15	11·85	12·0
Itaconic acid (g.)	1·39	2·85	2·25
Yield (molar) %	19·0	33·3	26·0

TABLE IV
(Concentration of KCl varied. Incubation Period 15 days)

	KCl absent	0·025% KCl	0·05% KCl
Dextrose consumed (g.)	12·98	11·25	10·28
Itaconic acid (g.)	4·0	3·17	3·0
Yield (molar) %	42·7	38·9	40·3

It was concluded that the optimum concentrations of the salts would be NH_4NO_3 0·1%, KH_2PO_4 0·05%, $MgSO_4$ 0·05% with or without traces of KCl. Further experiments are in progress with other substrates and the results will be published elsewhere.

The authors are grateful to Dr. S. H. Zaheer, Director of the Central Laboratories, for many helpful suggestions.

Cent. Labs. for Scientific and Industrial Research, Hyderabad-Dn., *October* 22, 1951.

K. RAMACHANDRAN.
Mrs. Z. H. OSMANI.

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THREE NEW BACTERIAL DISEASES OF PLANTS FROM BOMBAY

A NEW bacterial leaf-spot of *Lawsonia alba* Lam., was noticed at Baroda in October, 1950. On the leaves, the pathogen produces few, small, round, water-soaked areas, measuring initially 1 to 2 mm., mostly at the periphery of the leaf. Some of them increase in size to 2-3 mm. and become dark brown to jet black. On the other hand, undeveloped spots remain as pale brown specks, the areas around such spots turn pale brown and brittle. Bacterial ooze in the form of small shining beads or fine scales is found on both sides of the spot which gets depressed on the undersurface of the leaves, the corresponding areas on the upper surface being raised and presenting a pale white appearance due to bacterial exudation. The pathogen infects leaves only. Since no bacterial disease has so far been reported on this host or related plants, it is proposed to assign the bacterium a new name *Xanthomonas lawsoniæ* nov. sp. whose short description is given below :—

Short rods; single, rarely in chains of two; single polar flagellum; $0·7 \times 1·8\,\mu$; Gram-negative; capsulated; no spores; on potato dextrose agar plates, the colonies are circular with entire margins, smooth, shining, convex with striations at the periphery only, measuring 1·8 cm. after 5 days; colour empire yellow; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; hydrogen sulphide produced; ammonia produced from peptone; nitrite not produced from

nitrate; M. R. and V. P. tests negative; acid but no gas in dextrose, maltose, sucrose and lactose; no growth in salicin; optimum temperature for growth 30° C.; thermal death point about 51° C.; pathogenic to *Lawsonia alba* only. Found at Kamati Bag, Baroda.

2. A new bacterial leaf-spot of tamarind (*Tamarindus indica* L.), whose pods form a well-known condiment in India, was found quite common on trees round about Poona in November, 1950. On the leaflets, the pathogen produces few, small, round, water-soaked spots, measuring initially 0·5 to 1 mm. In the beginning, the spots are pale brown with a small, yellow halo around them which later increase in size to 3-5 mm., become irregular and dark brown to jet black. Spots also develop along the line of the mid-vein. Deep black spots on petiole and rachis are rarely seen. Bacterial ooze in the form of small, shining beads or fine scales is found on both sides of the spot which is raised due to heavy bacterial exudation. Since no bacterial disease has so far been reported on this host, it is proposed to assign the causal organism a new name *Xanthomonas tamarandi* nov. sp. whose short description is given below :—

Short rods; single; single polar flagellum; 0·6 to 1·6 μ; Gram-negative; capsulated; no spores; on potato dextrose agar plates, the colonies are circular with entire margins, smooth, shining, convex with striations at the periphery only, measuring 1·4 cm. after 5 days, colour martius yellow; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; hydrogen sulphide produced; ammonia produced from peptone, nitrites not produced from nitrate; M. R. and V. P. tests negative; acid but no gas in dextrose, maltose, sucrose and lactose; no growth in salicin; optimum temperature for growth 30° C.; thermal death point about 51° C.; pathogenic to tamarind; distribution general.

3. A severe bacterial angular leaf-spot of *Euphorbia pulcherrima* Willd. (Poinsettia) was observed at Bombay in December, 1950. On the leaves, the pathogen produces few to numerous minute water-soaked spots visibly clear on the lower surface, measuring initially 0·5 mm., fairly well distributed all over the leaf surface. With the progress of the disease, the spots increase in size to 1·5 mm., become angular and brown with deep coloured periphery. Like other bacterial diseases, the ooze in the form of small shining beads is found on the underside of leaves. Tender stems are infected in the form of irregular vertical gray streaks which soon engirdle the stem. In this respect, the disease resembles the one described by Starr and Pirone (1942).[1] But the causal organism under study differs from *Corynebacterium poinsettiæ* Starr and Pirone as it is Gram-negative and yellow; hence it is proposed to assign it a specific name *Xanthomonas poinsetticola* nov. sp. whose short description is given below :—

Short rods; single or in chains of two or three; single polar flagellum; 0·6 × 1·3 μ; Gram-negative; capsulated; no spores; on potato dextrose agar plates, the colonies are circular with entire margins, smooth, shining, convex with striations at the periphery only; measuring 2 cm. in diameter after 5 days; colour picric yellow; gelatin liquefied; starch hydrolysed; casein digested; milk peptonised; litmus reduced; hydrogen sulphide produced; ammonia produced from peptone; nitrites not produced from nitrate; M. R. and V. P. tests negative; acid but no gas from dextrose, maltose, sucrose, and lactose; no growth in salicin; optimum temperature for growth 30° C.; thermal death point about 51° C.; pathogenic on *E. pulcherrima* only, found in Hanging Gardens, Bombay.

Fuller details will be published elsewhere.

Plant Pathological Lab., M. K. Patel.
Agricultural College, Poona, V. V. Bhatt.
August 9, 1951. Y. S. Kulkarni.

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POLYPLOIDY IN A SHORT-HORNED GRASSHOPPER

Mickey[1] reported polyploid spermatogonial cells in a North American genus, *Romalea microptera* (Beauv.) and also studied the meiotic mechanism in them. The present author also obtained a sporadic case of tetraploidy in the spermatogonial stage in an Indian Acridid, *Oedaleus abruptus* Thunb., obtained from Izatnagar, Uttar Pradesh, and the finding is reported herein.

Out of many specimens examined, only one individual showed polyploidy in one of its testicular follicles. The closed tip of this particular follicle had two distinct cysts on either side—both being tetraploid ones. The two X-chromosomes in these tetraploid nuclei were found to be negatively heteropycnotic. The number of chromosomes in only two nuclei could be counted accurately (Fig. 1); while in the remaining ones it was not possible as they were

on the side. The chromosome number in these nuclei was found to be $4n = 44$, two less than what is expected. The missing ones were perhaps overlapped by some other chromosome which could not be detected or they were

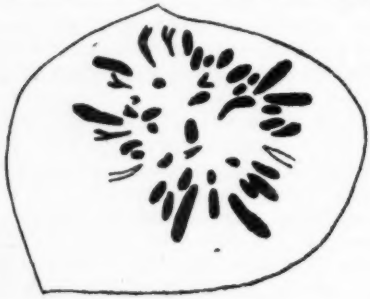

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FIG. 1. Spermatogonial metaphase in *Oedaleus* showing $4n = 44$ Chromosomes, × 1760.

lost during sectioning. Tetraploid metaphase stage may originate due to complete separation of chromatids during prophase with omission of one metaphase,[2] by fusion of daughter nuclei following anaphase separation and the failure of cytokinesis,[3] or by fusion of two prophase nuclei in a binucleate cell when the nuclear membrane is dissolved prior to metaphase.[4] Koller[5] described tetraploid spermatogonia in *Hexacentrus mundus*, a long-horned grasshopper; but due to the absence of syndiploidy in that genus he believed that those originated through failure of the daughter chromosomes to segregate towards the opposite poles at mitotic anaphase. Since the number of polyploid cells, obtained in the present case, was very few which, moreover, were localised in only one of the follicles, it was not possible to conclude by what particular method they had taken their origin. Further observations based on smears may give valuable information on this point.

My thanks are due to Dr. P. Bhattacharya, Indian Veterinary Research Institute, for giving me necessary facilities and for helpful criticism.

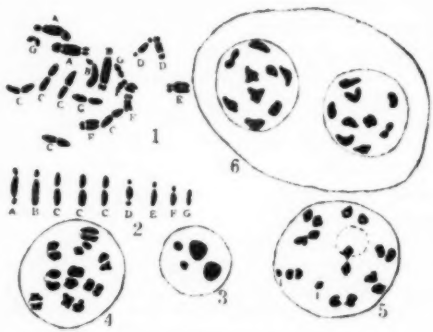
Animal Genetics Section, M. K. DUTT.
Ind. Vet. Re. Institute,
Izatnagar, U.P.
August 29, 1951.

1. Mickey, G. H., *Rec. Gen. Soc. Amer.*, 1945, **13**, 27. 2. Carothers, E. E., *J. morph.*, 1940, **66**, 529. 3. Wilson, E. G., *The Cell in Development and Heredity* (Macmillan, N. Y.), 1928. 4. Ray Chaudhuri, S. P., and Ira Bose., *Proc. Zool. Soc. Beng.*, 1948, **1**, 1. 5. Koller, P. C., *Proc. Roy. Soc. Edin.*, 1940, **60**, 174.

CYTOLOGY OF *LIMNANTHEMUM CRISTATUM* GRISEB.

THOUGH many important genera of the family Gentianaceæ have been worked out till now[1,2,5] several of the Indian members still remain unexplored. *Limnanthemum cristatum* Griseb. is one of the most widely distributed species of the family growing abundantly in ponds, both mitotic and meiotic studies of which have been made here.

For the study of the mitotic chromosomes, root tips were fixed in different fixatives of which Oxyquinoline fixation (Sharma and Ghosh, 1950), proved to be the most suitable one. Tjio and Levan's method (1950), for temporary preparations has also yielded very good results (Fig. 1). The materials fixed for preparing permanent blocks were dehydrated and infiltrated as usual and paraffin sections 15 μ thick were cut. For the study of the meiotic stages flower buds were smeared in Nawaschin's fluid.



FIGS. 1-6. (× 1,800)

FIGS. 1 and 2—Somatic Metaphase plate showing 18 chromosomes (fixed in Oxyquinoline) and Idiogram of the same respectively.

Fig. 3—Telophase nucleus showing 4 nucleoli.

Figs. 4 and 5—Diakinesis showing 9 bivalents, and 8 bivalents and 2 univalents respectively.

Fig. 6—Second Division nuclei showing 9 chromosomes in each.

The somatic chromosome number of the species has been found to be 18. The chromosomes could be classified mainly on the basis of their primary and secondary constrictions. Size lifference has not been found to be very marked, ranging between 1·5 μ to 3·7 μ. The details of the morphology are illustrated in Fig. 2.

Corresponding to 4 SAT-chromosomes, 4 nucleoli forming two homomorphic pairs were observed in the telophase stage of root tip nuclei (Fig. 3).

During the meiotic stages, 9 bivalents were distinctly noticed in the pollen mother cells. Diplotene presents an interesting peculiarity in the complete terminalisation of the chiasmata. Moreover, it is also worthy of note that chromatid separation is apparent at this stage (Fig. 4). Occasional pollen mother cells were observed with 8 bivalents and 2 univalents in diakinesis (Fig. 5).

Clear 9 bivalents were noticed in the metaphase and distinct 9 and 9 segregation in two poles resulting into clear 9 chromosomes in each of the second division nuclei were also observed (Fig. 6).

Pollen sterility has been found to be negligible.

The absence of any multivalent formation or of secondary association of bivalents and, moreover, the absence of any significant meiotic irregularity show that the species under investigation is, in all probability, a true diploid.

Lastly, I wish to express my sincere gratitude to Mr. A. K. Sharma, Calcutta University, for helpful guidance, and to Prof. P. C. Sarbadhikari, for facilities offered during this investigation.

Cytogenetics Lab.,
Dept. of Botany, (Miss) Archana Mookerjea,
Calcutta University,
September 8, 1951.

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SMUT ON *ECHINOCHLOA COLONA* LINK.

*Echinochola colona** is a good fodder grass found commonly on the banks of rivers, on bunds in paddy fields, and in marshy localities of the Mysore and Mandya Districts of Mysore State. During the course of a survey made in October, 1949, a smut producing galls on the grass was noticed. The galls occur on the stems and nodes, and sometimes on the rachis of the inflorescence (see Fig. 1). In many cases the inflorescence fails to appear. Where it does appear, the rachis is hypertrophied, and a few spikelets are seen. The parts of the spikelets themselves are unaffected. The leaves are free of the infection. The galls are irregular or elongated, and vary in length from 2 to 12 mm. and in thickness from 2 to 4 mm. (see Fig. 2). They occur crowded together so that the smut sori have the appearance of brain-like folds.

The sori are composed of the host tissue, and contain a mass of loose sooty powder, the spores of the fungus. The spores are liberated by the rupture of the gall membrane. The spores are roundish or ellipsoidal, brown, thinly echinulate, measuring 7·6-11·4 μ in greatest diameter. They germinate in tap water in 18-24 hours producing a septate promycelium. The sporidia are terminal or lateral. The fungus has been identified as *Ustilago crus-galli* Tracy and Earle.

Tracy and Earle reported this fungus on *Echinochloa* (*Panicum*) *crus-galli*, the Barnyard grass in U.S.A. It has been found also in Australia on the same grass. Mundkur[1] has noticed *U. crus-galli* on *E. frumentacea*. This host plant has been variously considered to be a variety of *E.* (*Panicum*) *crus-galli*, and *E.* (*Panicum*) *colona*, but has, since 1936, been accorded an independent status. According to Mundkur[1] the smut *U. panici-frumentacei sensu* Butler on *E. frumentacea* (*Panicum frumentaceum*), but not *U. panici-frumentacei* Brefeld is *U. crus-galli*. There is no record of this

* We are indebted to Fr. H. Santapau, S.J., t. Xavier's College, Bombay, and Sri. C. Rajasekhara Mudaliar, Government Lecturing and Systematic Botanist, Agricultural College and Research Institute Coimbatore, for independently identifying the specimens' of this grass.

fungus on any other grass or cereal in India. It is strange that if *E. frumentacea*, is a variety of *E. crus-galli* or *E. colona* any of these grasses has escaped infection by the smut. It could not have gone unnoticed because of the marked deformities it causes on the plant. This present record brings out the affinities of the fungus and the host plants it infects.

Lab. of Plant Pathology, S. V. VENKATARAYAN.
Dept. of Agriculture, M. H. DELVI.
Bangalore,
September 17, 1951.

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MULTIPLE BUDS IN SUGARCANE

WHILE one bud is the usual condition in sugarcane, the occurrence of buds more than one was noticed in a few hybrid seedlings. These multiple buds 2 to 4 in number are juxtaposed along the root band almost touching one another. All the buds at a node are of similar size and form. However, not all the nodes in a seedling showed this condition. A few had single buds, some had two buds, and a majority three buds and very few, four buds. The occurrence of multiple buds could be of practical importance especially in sugarcane provided they are viable and give rise to as many daughter culms as there are buds in each node.

The occurrence of multiple buds has been noticed in the following varieties.

(1) Co. 781—(P. 3247 × Co. 440).
(2) P. 7281—(Co. 603 × Co. 449).
(3) P'. 335/1—M. 2811 (Vellai × Narenga × [(*S. spontaneum* Glagh × *E. Munja* Spiny) selfed].

Neither of the parental forms in each cross showed this character and if this character expresses itself in the hybrid, the indication is that it is a case of two non-allelic genes acting together to produce a phenotype (so far as this character is concerned) different from that produced by either alone. This is on the assumption that the character in question is genic. If so, this feature must be exhibited by the clonal progeny resulting from these culms.

To test this, setts having one, two, three and four buds from each seedling were planted separately in pots having the ordinary soil mixture of tank silt, sand and farmyard manure. In every case only one bud germinated to form shoots. These were allowed to grow up to maturity and the canes were examined for the presence of multiple buds. There were no more than a single bud at each node. Also the shoots that came out of setts having one, two, three and four buds, were all identical. None of them possessed multiple buds. These were again planted and taken through the next generation. These also showed no trace of this character.

The occurrence of multiple buds is obviously not a genetically inherited character. Presumably it is due to some physiological cause, involving hormones or effect of minor elements on the varieties concerned.

Sugarcane Breeding Institute, T. S. RAGHAVAN.
Coimbatore,
September 26, 1951.

CONTROL OF TERMITES IN SUGARCANE

GUPTA[1] has made certain recommendations towards the control of termites during the period of germination in hot weather. The author has also made attempts to control their attack by the use of tar emulsion, crude oil emulsion and tar emulsion with 'gammexane', the treatments being given with irrigation water. Some measure of success was achieved particularly with the last mentioned treament, but the effect was only temporary and the treatment had to be repeated with each irrigation till the plant got established.

With a view to obtaining effective permanent control over termite attack, an experiment was conducted using two varieties, *viz.*, Co. 419 and Co. 453. The following treatments were given to the setts prior to planting: (1) plugging the cut ends with coal tar, (2) treating the setts for 24 hours in a 2·5% solution of 'gammexane' P. 520, (3) treating the setts for 24 hours in a 5% solution of 'gammexane' P. 520, (4) treating the setts for 24 hours in a 2·5% solution of DDT Geigy's Guesarol 550, (5) treating the setts for 24 hours in a 5% solution of DDT Geigy's Guesarol 550, (6) treating the setts for 24 hours in a 4% solution of the disinfectant 'IZAL'. In addition to these, in a separate experiment the furrows were treated with 5% gammexane dust D. 025 at the rate of 20 lb. per acre at the time of planting (without the other treatments).

Maximum germination was recorded in the treatments with 'gammexane', those with DDT coming next in order. Germination was considerably affected in the treatment with 'IZAL' solution.

The termite attack was maximum in the 'control' and in the treatment with plugged cut ends. The mode of entry was, however, different in the two. In the former the entry was through

the cut ends while in the latter it was entirely through the buds. This is evidently due to the cut ends being repulsive owing to the presence of coal tar, so that the termites had to seek the next best soft portion, *viz.*, the bud. The attack was fairly high in the treatment with 'IZAL'. The treatments with DDT also showed a fair amount of attack which was least in the treatments with 'gammexane'. Out of the three treatments with gammexane the dipping of the setts in 5% gammexane was superior to the others in the matter of less of attack of the termites.

Of the two commercially popular insecticides, DDT and gammexane, the latter seems to be better for the control of termites, as also from the point of view of germination, as it was found that it does not affect the latter.

My thanks are due to Shri. N. L. Dutt, Director, Sugarcane Breeding Institute, for kind guidance.

Sugarcane Breeding Inst., G. NARASIMHA RAO.
Coimbatore,
October 4, 1951.

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A NOTE ON THE CHEMICAL COMPOSITION OF THE PENAEID PRAWNS OF MADRAS

THE nutritive values of prawns from Bombay (*Metapenæus* sp., *Parapenæus* sp., and *Acetes* sp.) have been estimated by Appanna and Devadatta[1] and of those from Calicut coast (*Penæus monodon, Penæopsis dobsoni, Penæus semisulcatus* and *Trachypenæus asper*) by Chari.[2] The results obtained by these authors show that the chemical composition of the body varies in the different prawns studied. Moreover, the above authors did not take into consideration factors like sex, size and seasonal changes. So an estimation of the chemical composition of four edible prawns available in Madras, *viz., Penæus indicus, Penæus carinatus, Metapenæus monoceros* and *Metapenæus dobsoni*, was attempted by the present author.

The chemical composition of both males and females of the four different species has been determined and tabulated. Each value presented in the table is the average of determinations of materials found in two lots of five prawns each. All the prawns chosen for analysis were of 11 to 14 cm. length and were collected from the sea during the months of June and July.

TABLE

Species	Sex	Water Per cent.	Fat Per cent.	"Solids" Per cent.	Per cent. Limit of error
Penæus indicus	M	76·18	1·04	22·25	0·53
	F	76·38	0·95	21·86	0·81
Penæus carinatus	M	73·26	1·08	25·09	0·57
	F	72·67	1·15	25·51	0·67
Metapenæus monoceros	M	77·86	0·91	20·75	0·48
	F	75·07	0·90	23·17	0·86
Metapenæus dobsoni	M	76·48	0·95	22·05	0·52
	F	77·54	0·89	20·82	0·75

It will be noted from the Table that in these four species of prawns differences due to sex are irregular and not marked. Estimations of the fat contents as well as the chemical composition of the body during the different seasons in prawns of different sizes are of value. Such a detailed study on *Penæus indicus* has been made and will be treated in a separate account elsewhere.

The author's thanks are due to Dr. C. P. Gnanamuthu for his kind interest and guidance, and to Dr. G. Krishnan for his helpful suggestions.

Zoological Res. Lab., V. GOPALAKRISHNAN.
University of Madras,
Madras 5,
September 28, 1951.

1. Appanna and Devadatta, *Curr. Sci.*, 1942, **11**, 333.
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FORKING OF FILAMENTS IN *PENNISETUM TYPHOIDES* STAPF. AND HUBBARD

THE spikelets of *Pennisetum typhoides* Stapf. & Hubbard are characterised by two kinds of flowers, the upper flower perfect and the lower normally staminate (at times infertile, absent or rarely perfect). The stamens are three in number in both the upper and lower flowers.[1] An examination of the spikelets of number of types was made; in one particular plant belonging to a bulk selection M.S. 5640 (Local Sajja, Adoni, Bellary District, Madras State) instead of the normal three stamens, a greater number was observed in each flower. To know more about the extra number

of stamens nearly two hundred spikelets were examined. In all the spikelets, it was found that the lower flower was absent and the upper flower had four stamens as a general rule. Two of the flowers had five stamens.

The origin of the extra stamen were studied. In all except one flower four distinct filaments were observed (Fig. 1).

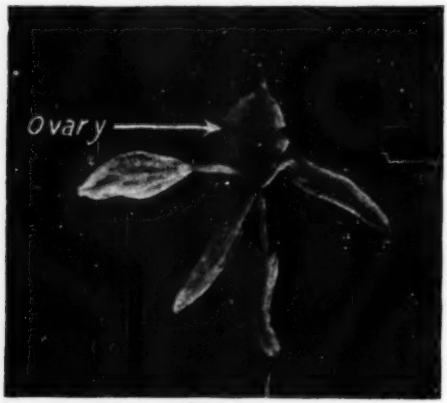

FIG. 1

In one particular flower, only three filaments were seen. One of these filaments had two distinct anthers, the filament having two branches at the distal end (Fig. 2).

FIG. 2

This observation gave the clue that the extra stamen which is found to occur should have arisen by the forking of one of the filaments, the general pattern of the flower being trimerous.

Forking of awns and leaf-blades in *Sorghum* has been reported.[2] Concurrent forking of awn and stigma has also been recorded[3] in the same crop. As far as the authors are aware this is the first record of forking of filaments in the Gramineæ.

The character is probably mutational in origin and the inheritance of it is under study.

Agric. Res. Stn., Koilpatti, *October* 5, 1951.

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R. APPATHURAI.

1 Hector, J. H., *Introduction to the Botany of Field Crops*, 1936, **1**. 2. *Curr. Sci.*, 1935, **4**, 316–17. 3. *Ibid.*, 1935, **4**, 176–77.

CHROMOSOME NUMBER OF *GYMNOPETALUM COCHINCHINENSIS* KURZ.

THE material for the study of meiotic chromosomes was obtained from male flowers of *Gymnopetalum cochinchinensis* Kurz., a wild monœcious species of Cucurbitaceae. Anthers were fixed in acetic-alcohol (1 : 2) between 1-30 p.m. to 1-45 p.m. Pollen mother-cells and pollen grains were studied in acetocarmine smears.

Diakinesis was the only stage of prophase which was studied. Eleven bivalents were counted in a large number of diakinetic nuclei (Fig. 1). The maximum number of bivalents found

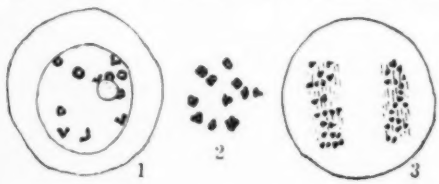

FIG. 1. Diakinesis, showing eleven groups of bivalents; note three bivalents attached to the nucleolus. FIG. 2. Metaphse I showing eleven bivalents. FIG. 3. Anaphase II showing lagging chromosomes. × 1000.

attached to the nucleolus was determined to be three. Whether this indicates that this species is a secondary polyploid or a structural hybrid calls for further critical examination of this plant.[1] In polar view metaphase I, eleven bivalents were observed (Fig. 2), so that eleven is the haploid number of chromosomes in this species.

During anaphase II, laggards were observed (Fig. 3) in a small percentage of pollen mother-cells. Microspores which result from divisions of such pollen mother-cells are usually deficient in some chromosomes and this is probably the reason for the abortion of approximately 20 per cent. of the pollen grains of this species. Occur-

rence of such laggards in anaphase II has been recently reported by Rao[2] in *Sterculia colorata*.

Tetrad formation was found to be of simultaneous type.

A brief survey of the chromosome numbers of the members of Cucurbitaceæ, so far studied shows that eleven is the haploid number of chromosomes in a number of genera which include *Citrillus, Lagenaria, Momordica, Trichosanthes*.[3] Further study will alone reveal whether any of these genera bears any relationship with *G. cochinchinensis* where also the haploid number of chromosome has been determined to be eleven.

Dept. of Botany, AHMAD SHAMSUL ISLAM.
University of Dacca, B. SAHA.
October 7, 1951.

1. Bhaduri, P. N., *Proc. Roy. Soc., London*, 1942, **44**, 73-85. 2. Rao, C. V., *Proc. Indian Sci. Cong.*, 1951, **38**, 156. 3. Darlington, C. D. and Janaki Ammal, E. K., *Chromosome Atlas of Cultivated Plants*, 1945, 114-16.

A PRELIMINARY ACCOUNT OF CYTOLOGY OF THE HOUSE FLY *MUSCA NEBULO* F.

THE attention given to the house fly, in comparison with other species of the Diptera, which have long been a favourite group for cytological studies, is very meagre. Upto now only *Musca domestica* L. has been studied cytologically and a diploid number of 12 chromosomes with "XY" type of sex mechanism and spermatogenesis has been reported (Perje, A. M., 1948*).

During the course of cytological investigation in an in-bred race of the house fly, *Musca nebulo* F., which is common in India, about 25 males examined hitherto showed 6 chromosomes only in the somatic cells (Fig. 1), whereas

FIGS. 1 and 2. Somatic complement of male and female house fly, *Musca nebulo* F. with 6 and 12 chromosomes respectively. × 2500.

all the females showed 12 chromosomes (Fig. 2). A comparative chromosome study revealed that the 12 chromosomes found in the female formed 6 homologous pairs while the 6 chromosomes in the male were without homologues. From the above data it is inferred, that the male flies under investigation show haploidy, which is probably the result of parthenogenesis, as in the bees and wasps.

Further work is in progress.

Our grateful thanks are due to Dr. P. J. Deoras for guidance and to Dr. S. P. Agharkar for his kind interest and encouragement.

M.A.C.S. Laboratory, S. VISHVESHWARAIYA.
Law College Buildings, D. R. RANADE.
Poona 4,
October 12, 1951.

* Ann Margret Perje, "Spermatogenesis in *Musca domestica* L." *Hereditas*, 1948, **34**.

BIONOMICS OF *PHLEBOTOMUS ARGENTIPES* (ANN AND BRUN)

IN the course of a study of the bionomics of the sandfly, *Phlebotomus argentipes* (Ann & Brun), the following observations were made :—

(1) Wild sandflies (*P. argentipes*), caught fed in nature, were placed in a chimney with raisins for 48 hours or longer. After they had oviposited, second feeds on man were obtained.

(2) *P. argentipes* was also found to take a meal of blood from chickens. It was noted that *P. papatasii* (Scop.) also would feed on chicken's blood. Both *P. argentipes* and *P. papatasii* laid viable ova after a blood meal on chickens.

It may be pointed out that the Kala-azar Commission when working in Assam, failed to obtain second feeds with sandflies caught fed in nature. Since sandflies have been shown to feed on chicken's blood, it will be interesting to find out the effect of chicken's blood on the development of flagellates of *Leishmania donovani* in the gut of the sandfly. Epidemiological studies on Kala-azar have revealed an association between poultry keeping and the prevalence of *P. argentipes* in Kala-azar houses.

Our thanks are due to Prof. K. V. Krishnan, Professor of Microbiology, for facilities to take the course in his department and for permission to publish this note.

K. P. BHATTACHARYYA.
M. G. RAJA VARMA.
N. R. RAMAKRISHNAN.
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All India Institute of R. RAMANI.
Hygiene & Public Health,
Calcutta,
October 16, 1951.

THE FIRST RECORD OF THE GENUS *BRANCHINELLA* SAYCE. IN INDIA AND A NEW VARIETY OF *BRANCHINELLA KUGENUMAENSIS* (ISHIKAWA)

In the course of my studies on the *Anostraca* of South India,[1,2,3] I received a collection of preserved *anostracans* from Madura, which have now been identified as resembling the Japanese form *Branchinella Kugenumœnsis* (Ishikkawa[4]) with certain differences.

The males are characterised by the biarticulate second antenna, with the basal joint carrying numerous tubercles on the inner margin, and 9 long digitiform processes on the outer margin (Fig. 1 *b*). The apical joint is falciform and

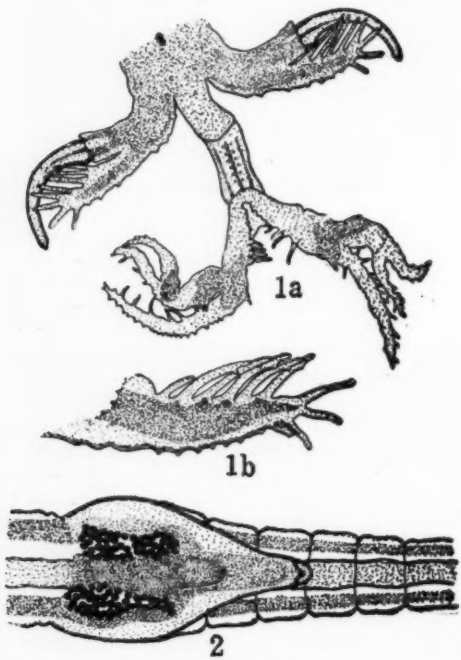

FIG. 1*a*. Frontal appendage and second antenna ×7½ (Camera lucida)

FIG. 1*b*. Part of the basal joint, showing the digitiform processes × 33 (Camera lucida)

FIG. 2. Ovisac × 8. (Camera lucida)

movable. The frontal appendage of male is three jointed. The basal joint is cylindrical, the middle with two rows of ventral spines is bifurcated at its tip into two rami. Each ramus is again triramous. The interior ramus is ensiform, with spines on either sides, and the two outer rami carry tubercles with minute spines (Fig. 1 *a*).

The females are characterised by the conelike small second antenna, with setose margin, and the apical end is acutely prolonged. The ovisac is short, oviform and extends to the end of the 4th abdominal segment (Fig. 2). The length of the body is 23 mm., thorax 10 mm., abdomen 9 mm. and caudal furca 4 mm.

These specimens were collected in August, from temporary puddles created by rain water, in and around Madura (S. India). A large number were available for detailed examination and they differ from Ishikawa's type specimen of Japan, with regard to the number of digitiform processes on the basal joint of the second antenna of the male, the shape and length of the ovisac, the size and shape of the flabella of the phyllopodia, and the spines on the frontal appendage.

Hence they can be conveniently treated as a distinct and a new variety of *Branchinella Kugenumœnsis* (Ishik.) and can be designated as the var. *Madurai*.

A detailed account of the morphology and bionomics of this new variety will be published elsewhere.

My thanks are due to Dr. Joshua for providing facilities for working, and to Mr. K. J. Joseph and Mr. G. J. Phanuel, for supplying the material.

This first record of the genus *Branchinella* Sayce. in India, extends the range of the distribution of the genus to the oriental region also.

Dept. of Zoology, P. J. SANJEEVA RAJ.
Madras Christian College,
Tambaram,
October 11, 1951.

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SOME SIGNIFICANT RECORDS OF FISH FROM KOLHAPUR, NORTHERN SECTION[1] OF WESTERN GHATS

Among the collection of fish made by Shri A. G. Kalawar, Superintendent of Fisheries, Kolhapur, the writer has found some interesting species which are of great zoo-geographical significance. One of them is a Homalopterid fish which belongs to the genus *Balitora* Gray.[2] It agrees more or less with the form described from Mysore, *B. brucei mysorensis* Hora.[3] This is the

first record of any Homalopterid fish from the northern division of the Western Ghats.[4] Another new record is *Botia striata* Rao,[5] a beautifully striped loach, which was described from Mysore, but has not so far been found from any other part of the Western Ghats.

The third interesting find is a catfish of the family Schilbeidæ, collected by the author, for which a new genus and new species have been established. The account is under publication in the *Records of the Indian Museum*. The nearest ally of this fish is *Pseudeutropius acutirostris* Day[6] from Burma. The occurrence of this new Schilbeid fish at Kolhapur emphasises further the great affinities of the fish fauna of the Western Ghats to the so-called Malayan fauna.[7]

The presence of these three fishes in the northern section of the Western Ghats supports Hora's Satpura Hypothesis[8] of the route of migration of the Malayan element in the fauna and flora of Peninsular India. A detailed systematic treatment of these along with other fishes collected from Kolhapur will be published elsewhere.

I am grateful to Dr. S. L. Hora, for his help in the identification of *Botia striata* Rao and to Dr. S. B. Setna, for affording the necessary facilities.

Taraporevala Marine Biological Station, Bombay,
November 2, 1951.

C. V. KULKARNI.

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THE PRESENCE OF *OPERCULINA GRANULOSA* (LEYMERIE)—FORAMINIFERA IN THE COASTAL WATERS OF TRAVANCORE

HOFKER[1] observes that *Operculina granulosa* shows a very high degree of variability, which in most cases seems to be due to trimorphism and in others, to outward circumstances, namely, the quantity of chalk and the depth of water in which it is found. Dakin[2] mentions the presence of *O. granulosa* in the Gulf of Manaar, but no other details regarding its form and the seasonal abundance are available.

During recent investigations of the Bottom Fauna and Bottom Deposits of the Travancore Coast, many specimens of three different forms of this species have been collected. The largest specimen obtained is $6 \times 4 \cdot 4$ mm. It possesses 41 chambers and resembles the type-specimen illustrated by Cushman[3] (Fig. 6*a*, Pl. XV). The spiral is very irregular in some specimens and the beads are visible only in the central spiral. This form is rather rare on this coast and has been recorded only from Trivandrum at a depth of 12-15 fathoms.

There is another form which resembles (Fig. 5, Pl. XV), of Cushman,[3] the largest specimen measuring $3 \cdot 7 \times 3 \cdot 5$ mm. and is more or less circular and possesses 34 chambers. Beads are present in all the whorls, except in the outer half of the peripheral whorl. It is found at Trivandrum and Vizhingom Coasts up to 15 fathoms.

Besides these two, there is another form which measures $4 \cdot 3 \times 3 \cdot 3$ mm., and in which the outer whorl is enormously enlarged. It resembles Fig. 2*a*, Pl. XVI, Cushman[3] and bears beads on the first two whorls. This form is only rarely obtained on this coast and the limited number of specimens collected was from Trivandrum, 12-15 fathoms.

Among the numerous species of foraminifera collected from the Travancore Coast this is the only large-sized species and it is abundant in the deeper waters of Trivandrum, between 14-16 fathoms and it constitutes even up to 1·2% of the total dry weight of the bottom deposit in the March collections. At times, the tubes of certain polychætes collected from this region are formed exclusively by the agglutination of the dead tests of this species.

Fisheries Research Station, Kayamkulam,
November 7, 1951.

C. V. KURIAN.

1. Hofker, J., *Siboga. Exped. Monogr.*, 1927, **4**, 1-78. 2. Dakin, W. J., *Cey. Pearl Oyst. Fish. Rept.*, 1936, **36**, 226-42. 3. Cushman, J. A. *Bull. U.S. Nat. Mus.*, 1933, **161**, pts. 1-3.

REVIEWS

The Manufacture of Iron and Steel. Vol. 2. By G. Reginald Bashforth. (Chapman & Hall), 1951. Pp. viii + 461. Price 45 *sh.* net.

The second volume on "The Manufacture of Iron and Steel", by G. Reginald Bashforth, keeps up the excellent standard set by the first volume. The text has been neatly divided into two basic parts, *i.e.*, iron production and steel production and deals at length with the basic theory underlying various processes which constitute the modern metallurgy of iron and steel. Details of plant and machinery illustrate the text profusely and these are notable for the reference to their actutal installation. The most notable feature of the text is the latest references to the work of numerous research workers published in various leading technical journals.

To the students of modern production metallurgy it should be an exceedingly useful publication. Although there are a number of textbooks in this field, none deals with the subject so comprehensively and effectively as the publication under review. To the production metallurgist it should readily present valuable reference data on various aspects of ferrous metallurgy.

The publication will admirably serve the purpose for which it is intended.

B. R. NIJHAWAN.

The Surface Chemistry of Solids. By S. J. Gregg, (Chapman & Hall Ltd., London), 1951. Pp 297 + ix. Price 30 *sh.*

The surface properties of solids have evoked considerable interest in recent years, especially in view of their important bearing on many practical and industrial problems. The book under review provides an excellent survey of the important aspects of recently published research on this subject.

It is happy to note that the scope of this survey is not limited to the chemistry of solid surfaces, for it covers important physical and mechanical properties as well. The chapters dealing with active solids, adsorption, friction and lubrication, chromatography and the wetting of solids by liquids have received very lucid treatment. A short chapter on the application of the electron microscope and electron diffraction has been well placed in this work.

Coming to purely chemical properties, the chapters dealing with catalysis and chemisorption deserve to be amplified. Though the author has candidly excused himself in the Preface for the choice of the subject-matter, "inevitably reflecting the particular interests and prejudices of the author", one cannot help noticing with surprise the total exclusion of the important contributions of Volkenstein in Russia and the rather thin treatment of the theory of activated adsorption. It would also have been desirable to include chapters dealing with the measurements of magnetic susceptibility and semiconductivity of active solids.

There are very few typographical or other errors in the text. On page 18, $\triangle H$ refers obviously to the differential heat of adsorption per gram mole (not per gram) of the adsorbate. On page 120, lines 9 and 28, read Fig. 50 for Fig. 52.

The survey has been presented in a swift and lucid style, which makes it sufficiently intelligible to the more advanced undergraduate student. To the researcher, it provides a key to the vast complexity of literature on the physics and chemistry of surfaces. The printing and get-up of the book are both commendable.

M. V. C. S.

Chemistry and Biology of Proteins. By Felix Haurowitz. (Academic Press Inc., New York), 1950. Pp. xii + 374. Price $5.50.

The circumstance that proteins constitute the fundamental substrate of living matter, has lent to the subject an unchallenged position of importance which is shared by few other topics. The exceptional significance of proteins in biological chemistry is realised if attention is called to the fact that some of the vital components of life, enzymes, hormones, antigens, antibodies and viruses fall into the domain of proteins.

The absence of a suitable text-book on this subject giving a "uniform outline of the present state of the protein problem" for the benefit of students of chemistry and of biological sciences, has long been felt and the distinguished author, by presenting this excellent volume under review, has earned the gratitude and admiration of his readers.

In writing the text, the author has kept in mind the requirements of those interested in the fundamental aspeects of the subject. The main topics which are discussed in a series of 17 brilliant chapters, include (1) protein structure, (2) biological activity of proteins, and (3) their biosynthesis in the living cell.

An admirable feature of the volume is the way in which the author has harmonised the old and the new concepts of the nature of the protein molecule and its varied reactions and manifold functions. For brevity of style and clarity of expression, there are few texts which can equal this treatise, which represents an inspiring model for others to follow. We have no doubt that this volume will command a large audience.

Parasites of Domestic Animals. By T. W. M. Cameron. 2nd Edn. (Published by Adam & Charles Black, London), 1951. Price 38 *sh.*

This is a completely revised edition of Professor Cameron's earlier text-book "The Internal Parasites of Domestic Animals, 1934", enlarged, to include the external parasites also, which has necessitated the change in the title. The arrangement of the subject-matter is quite original and is a result of the author's vast experience as a teacher at the London School of Tropical Medicine and at the Institute of Parasitology of Canada. The pictorial diagrams showing the situations of the parasites in their hosts and their life-histories are very illustrative and greatly enhances the usefulness of the book. In the chapter on "Immunity", the subject-matter has been admirably dealt with in a clear lucid manner. A new chapter has been added, dealing with the principles of the control of parasitic diseases in the light of the latest researches and field experience. Parasites found under all climatic conditions have been included with one exception which struck the reviewer prominently, the absence of the mention of *Schistosoma nasalis*, Rao, 1932, a severe pest of cattle in this part of the country, whose identity and pathogenesis have been firmly established.

It can be confidently stated that there is no other text-book on the subject in which the systematics of the parasites and details of the diseases caused by them and their treatment are so well blended to form a concise book. This is useful to the practitioner who may be interested only in the diseases, and also to others. who may like to have more information about the parasites causing the diseases. This book can be specially recommended, as a model text-book for students of the Veterinary Colleges.

N. S. K. R.

Chemical Control of Insects. By T. F. West, J. Eliot Hardy and J. H. Ford. Frontiers of Science Series. (Chapman & Hall Ltd., London, W.C.2), 1951. Pp. 211. Figs. 44. Price 15 *sh.* net.

Modern entomological research requires a knowledge of many "border" sciences of which the chemistry of insecticides is one. While the book is mainly of interest to the toxicologist, it contains much which will be useful to the general entomological worker. The authors emphasise that a knowledge of the life-history and behaviour of the pest and the niche it fills, in its natural environment, is necessary for successful application of control methods. Each species of insects, therefore, presents as it were, a fresh problem for study. The various methods of pest control have been contrasted, with a knowledge of the action of the chemicals on the insect body. The chapter on fumigation gives useful details about factors influencing action of fumigants, and their properties and uses.

There are sixteen chapters, dealing with the early history, chemistry and insecticidal uses of insecticides, like the nicotine, rotenone, arsenical compounds, petroleum oils, tar oils, etc.; and also giving good account of repellents and attractants; and weed control. The chapter on chlorinated hydrocarbons, while giving the chemistry, agricultural and horticultural uses of D.D.T., B.H.C., chlordane and toxaphene, indicates the possibilities for new and even more potent synthetic compounds. Each chapter ends with a list of useful "References". The get-up of the book is also attractive. The book is very useful to the Economic Entomologist to get a picture of the chemistry of the insecticides with which he is connected professionally.

M. PUTTARUDRIAH.

Parasitic Animals. By Geoffrey Lapage. (Cambridge University Press). Pp. xxi+351. Price 21 *s.* net.

This is a handy volume on the ecto- and endoparasites, excepting bacteria and fungi affecting man and his domestic animals. The author has taken considerable pains to describe concisely the life-history, method of contact and attachment and effects of parasitism on the host and the parasites, and the method of prevention. The subject has been well arranged and classified and treated in a manner intelligible even to the lay reader.

The author concludes in a philosophical vein and makes the reader ponder over the purpose and the force behind all these phenomena. These, we learn, are to be dealt with in a volume which is soon to follow.

K. P. MENON.

The Plant Glycosides, By R. J. McIlroy (Edward Arnold & Co., London). Pp. 138. Price 18 *sh.* net.

An up-to-date book on plant glycosides would certainly be a welcome addition to chemical literature, since earlier works were published some twenty years ago. The present small volume is claimed to contain only notes collected in connection with research work on natural products in the University College, Ibadon, Nigeria and is not intended to be more than an up-to-date summary for convenient reference by chemists, agriculturists and botanists. Its scope is therefore, naturally limited. Even so, the book contains a large number of errors that reduce its usefulness. The following represents a casual collection of such: p. 31—"The glucuronic component in baicalin is attached to position 6". Shibata and Hattori to whom reference is made, consider that it is probably in the 7-position. Actually its reactions resemble those of the 7-methyl ether of baicalein; p. 33.—Ononetin is "7-hydroxy-4'-methoxy iso-flavone"; p. 35.—Galangin is the "glycoside of 5 : 7-dihydrory flavonol"; p. 35.—Gossypin is isolated from "Egyptian cotton flowers"; p. 39.—Citronetin is synthesised from "phloroglucinol and 6-methoxy cinnamaldehyde"; p. 120.—Prunitrin is "7-methoxy- 4' : 5-dihydroxy-iso-flavone".

Literature references are claimed to be complete upto October, 1950. Though this is roughly met, there are omissions of papers published earlier as the following examples will show: P. 31—For galuteolin only the very old reference of Barger and White is given. A later reference (*Chem. Abs.*, 1940) is not found. P. 35—A later reference to cannabiscitrin is not mentioned (*Proc. Ind. Acad. Sci.*, 1946, **23 A**, p. 296). P. 40—The earlier work of Rangaswami, *et. al.*, in determining the position of sugar residue in naringin has been omitted (*Proc. Ind. Acad. Sci.*, 1939, Vol. 9), whereas the later repetition of the same in 1944 is mentioned. The actual synthesis of carthamidin and iso-carthamidin published in 1949 is not mentioned.

Thus, critical appraisal of past literature and correct expression seem to be seriously lacking. The printing and get-up of the book are quite good, but the cost seems to be too high.

T. R. S.

The Invertebrates Acanthocephala, Aschelminthes and Entoprocta, Vol. III. By L. H. Hyman. (McGraw-Hill, New York), 1951. Pp. vi + 572. Price $ 9.00.

The present volume on the invertebrates completes the consideration of the acoelomates or the *Pseudoceolomata bilateria* as the author describes them. Like its predecessors, this work is also largely a compilation, of course, backed by the original researches of the author. As the author herself points out, there is not much work done on the Nematodes and had the author started making original investigations on this group, probably the publication of the present volume would have been indefinitely postponed, much to the disappointment of teachers and researchers. On the other hand, a much needed comprehensive original account on the Nematoda would have been available.

Each of the Chapters (XII, XIII and XIV) is devoted to a phylum. Comparing the Acanthocephala, system by system, with the Platyhelmia on the one hand, and Aschelminthes on the other, the author points out that its relation with the flatworms or the other cannot be definitely settled. It is, therefore, thought best to treat the phylum separately which show, however, affinities with them. Under Aschlminthes are included Rotifera, Gastrotricha, Kinorhyncha, Priapulida, Nematoda and Nemtomorpha which may appear at first as a heterogeneous assemblage of groups. One is amused to read that in the lowly rotifers, different species exhibit a predilection in choosing definite plants for attachment; even more interesting is the fact that particular locations on the axis of aquatic plants are selected by them! In describing the development of *Parascaris* (p. 225), no reference is made to the important phenomenon of 'chromatin diminution' though it is described separately on page 260. It is likely that students reading this description of Nematode embryology may lose sight of this very important fact. It is interesting to note that while *Parascaris* parasitises only the equidæ, the unfortunate dog harbours at least twenty different genera in its body!

While under Acanthocephala and Entoprocta a useful account of the morphology and physiology of the phyla is given, such an account has obviously not been possible under the Aschelminthes.

The volume under review is not meant to be used as a text-book; but it is an excellent reference work and further is undoubtedly indispensable to the researcher in the field comprising the three phyla. The figures are either original or are specially redrawn for the book. The bibliography is very exhaustive. The author and the publishers deserve our gratitude.

L. S. R.

Report of the Proceedings of the Symposia on Fuels, Fats and Oils, and Research and Industry. (Published by the Central Laboratories for Scientific and Industrial Research, Hyderabad). 1951. Pp. vi + 206. Price Rs. 5.

As pointed out by Sir J. C. Ghosh in his inaugural address, the industrial prosperity of a State in this scientific age is intimately connected with a planned development of its resources through research. The speakers who took part in the symposia, therefore, did well in taking up only such topics as were related to the national needs and demands rather than dealing wih too technical and theoretical discussions. Eighteen subjects were discussed at the meetings covering a wide range of topics such as briquetting and low temperature carbonisation of non-caking coal; fluidisation of coals; research in refractory materials; combustion of non-caking coals in a fuel bed; edible fat industries in India; castor oil and its gel; utilization of seed oils as surface-coating materials; keeping quality and nutritive value of fats, etc. In addition, an interesting section devoted to various aspects of application of research to industrial production is also included. This is a subject which, no doubt, needs particular attention from all those engaged in research if the country is to achieve economic independence speedily. The papers read at the meetings, and the discussions which followed, are now brought together in the form of a book which should provide valuable reference material. The printing and general arrangement of the material have been done with considerable care.

N. N. DASTUR.

Books Received

Machine Shop Mathematics, Second Edition. By Aaron Axelrod. (M/s. McGraw-Hill Books Inc.), 1951. Pp. ix + 359. Price $ 3.60.

Evolution, Second Edition. By A. Franklin Shull. (M/s. McGraw-Hill Books Inc.), 1951. Pp. ix + 322. Price not given.

A Text-Book of Physiology. By P. L. Kolhhar. (Atma Ram & Sons, Delhi), 1951. Pp. ix + 316. Price Rs. 10.

Photosynthesis and Related Processes, Volume II, Photosynthetic Pigments, Kinetics of Photosynthesis). By Eugene I. Robinowitch. (M/s. Interscience Publishers), 1951. Pp. xi + 603-1,208. Price $ 15.00.

The Origin, Variation, Immunity and Breeding of Cultivated Plants (Selected Writings of N. I. Vavilov). Translated by K. Starr Chester. (M/s. Chronica Botanica Co.), 1949-50. Pp. xviii + 364. Price $ 7.50.

Isotopes in Biochemistry. Edited by J. N. Davidson and 4 others. (M/s. J. A. Churchill Ltd.), 1951. Pp. xv + 288. Price 27 *sh.* 6 *d.*

Partial Differentiation. By R. P. Gillespie. (M/s. Macmillan & Co.), 1951. Pp. viii + 105. Price 6 *sh.*

Electrical Engineering Economics, Second Edition, Vol. 2. By D. J. Bolton. (M/s. Chapman & Hall), 1951. Pp. xi + 307. Price 30 *sh.*

Text-Book of Electrochemistry—II. By Kortum and J. O. M. Boekris. (M/s. Elsevier Publishing Co.), 1951. Pp. xiii + 353-882. Price 70 *sh.*

Facts, Files and Action in Business and Public Affairs, Part I. By J. E. Holmstrom. (M/s. Chapman & Hall Ltd.), 1951. Pp. xvi + 449. Price 36 *sh.*

Vitamins—A Digest of Current Knowledge. By Leslie J. Harris. (M/s. J. A. Churchill Ltd.), 1951. Pp. xii + 244. Price 15 *sh.*

A Text-Book of General Physiology. By Hugh Dawson. (M/s. J. A. Churchill Ltd.), 1951. Pp. xiii + 659. Price 45 *sh.*

Vacuum Physics (A Symposium), *Journal of Scientific Instruments*, Supplement No. 1. Edited by H. R. Lang. (Institute of Physics), 1951. Pp. iii + 80 + viii. Price 15 *sh.*

Advances in Enzymology, Volume 12. Edited by F. F. Nord. (M/s. Interscience Publishers), 1951. Pp. ix + 570. Price $ 9.75.

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SCIENCE NOTES AND NEWS

International Symposium on Desert Research

The Research Council of Isreal in co-operation with UNESCO is planning to hold a symposium on Desert Research in Jerusalem in May, 1952. The symposium will be under five sections: Climate, Soil, Water, Energy and Biology. Many specialists have already agreed to participate in the programme.

Symposium on Utilization of Industrial Wastes

A symposium on Utilization of Industrial Wastes will be held under the auspices of the National Chemical Laboratory of India, Poona, on February 13, 1952, and the following days. Important problems of utilization of waste from various industries are expected to be discussed in all their aspects by leading industrialists and scientists in the country. Enquiries in this regard may be addressed to Dr. J. V. S. Ramanjaneyulu, National Chemical Laboratory, Poona 7.

Dr. T. J. Job

Dr. T. J. Job, Chief Research Officer, Central Inland Fisheries Research Station of Government of India at Barrackpore, has been appointed Assistant Regional Fisheries Officer for Asia and the Far East, with headquarters at Bangkok.

Dairy Science Abstracts

Dairy Science Abstracts, published by the Commonwealth Bureau of Dairy Science, Shinfield, Reading, England, will be appearing as a monthly instead of a quarterly publication beginning with Volume 14, No. 1 (January), 1952.

Application from Scientific Workers

Agreeing to the suggestion made by the Association of Scientific Workers of India, the Government of India have issued a notification to the effect that in future any qualified scientific worker employed under the Ministry of Finance, etc., will be allowed full opportunities to apply for posts advertised by Union or State Public Service Commissions or other bodies for which they are qualified, provided their services can be spared without detriment to the work they are engaged on.

Raptakos Awards for Medical Research

Raptakos Medical Research Board Fellowships for the year 1952 have been awarded to the following candidates for research work in subjects mentioned against their respective names:

(1) Mr. D. V. Rege, University Department of Chemical Technology, Bombay. *Role of Folic Acid and Vitamin B_{12} in Nucleic Acid Metabolism.*

(2) Miss Vatsala N. Thakur, Tata Memorial Hospital, Bombay: *Isolation of Carcinogenic Substances from Tobaccos used for Chewing in India.*

(3) Mr. M. Bhimasena Rao, Indian Dairy Research Institute, Bangalore: *Milk Diets in Relation to Infantile Cirrhosis.*

(4) Dr. K. Gopalachari, Government General Hospital, Madras: *Hypertension.*

Bose Research Institute

The Thirty-fourth anniversary of the Bose Research Institute was celebrated on the 30th November, 1951, when Prof. P. C. Mahalanobis, F.R.S., Statistical Adviser to the Cabinet, gave the Thirteenth Acharya Jagadish Chandra Bose Memorial Lecture on "Statistical Methods in relation to National Development".

With reference to the work of the Institute, the Director, Dr. D. M. Bose, said that cosmic ray investigations are to begin shortly and that the cytological and mutagenic action of X-rays, ultraviolet rays, ultrasonic radiation, as well as of different chemical reagents is being pursued. The effect of penicillin in inhibiting the growth of soil organisms, producing cytological effects on plant cells have been studied. It has been found that while the normal period of transformation of tadpoles to frogs takes place in about three weeks, tadpoles kept for some time in a dilute penicillin solution and then transferred to their normal habitat in water have continued to grow and increase in size for six months without being transformed into frogs.

CORRECTION

Vol. 20 No. 10. Read *Cyperus Scariosus* for *Cyprus Scariosus* (p. 273), and *Stemphylium Ilicis* for *Stemphyllium Ilicis* (p. 276).

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